REVISION, PHYLOGENETIC, BIOGEOGRAPHIC, AND HOST ANALYSES OF THE ENDEMIC WESTERN NORTH AMERICAN *PHYMATOPSALLUS* GROUP, WITH THE DESCRIPTION OF 9 NEW GENERA AND 15 NEW SPECIES (INSECTA: HEMIPTERA: MIRIDAE: PHYLINAE)

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ABSTRACT

Phymatopsallus Knight, 1964 and related genera endemic to the American Southwest and northern Mexico are revised. Nine new genus-group and 15 new species-group names are proposed. One previously proposed genus-group name and 9 species-group names are treated as junior synonyms. Color digital habitus illustrations of male specimens are provided for all species and females for most species; line drawings of male genitalia are provided for all species; line drawings of female genitalia are provided for one or more representatives of most generic groupings; scanning electron micrographs are used to illustrate a standard set of features for most taxa. Maps are provided to portray the distributions of all *Phymatopsallus*-group taxa and the outgroup taxon *Schaffneropsallus*, new genus. A phylogenetic analysis is conducted for 29 ingroup and 3 outgroup taxa. Distributional patterns and host associations are analyzed and discussed.

INTRODUCTION

The first species belonging to the *Phymatopsallus* group of genera were described by E.P. Van Duzee from California and Baja California, Mexico, between 1917 and 1923. Although he placed his new taxa in the Palearctic genera *Psallus* Fieber and *Tuponia* Reuter, Van Duzee had apparently recognized the distinctive nature of the genitalia of some species. For example, in his description of *Psallus croceus*, Van Duzee (1918) mentioned the condition of the left and right parameres, referred to by him as claspers. He later continued with this approach, also mentioning the presence of an "erect tubercle" on the pygophore (= genital capsule, abdominal segment 9 in male) in *Psallus tuberculatus* (Van Duzee, 1923). According to T.J. Henry (personal comm.), the introduction of observations on the value of male genitalia in Miridae taxonomy may have derived from conversations between Van Duzee and H.H. Knight, and probably the publication of Knight's contemporaneous papers (e.g., Knight, 1916, 1917), in which the latter author had documented the value of male genitalic structures for the separation of species within the Miridae.

Van Duzee's species remained in their genera of original description until Knight (1964) described the new genus *Phymatopsallus* from the southwestern United States to include 15 new species, as well as three species previously described in *Psallus* by Van Duzee. Knight (1968) later described an additional two new species from Nevada in conjunction with his work on the Miridae of the Atomic Test Site. Knight (1964) recognized species as belonging to *Phymatopsallus* by virtue of their having simple as well as sericeous, woolly pubescence on the dorsum, and by having a tubercle on the left side of the pygophore in conjunction with the presence of a conspurcate (= marmorate) membrane. He contrasted the group only with *Psallus*. This comparison now has little value because Knight's characterization of *Psallus* was not closely tied to the type species, *P. sanguineus* (Fabricius). Furthermore, subsequent work has shown that many of the species placed in *Psallus* by Knight are in reality not closely related to that group (Schuh, 2000a, 2000b, 2001), most of whose species occur in the Palearctic, while all *Psallus* species occurring in North America are widespread and some are possibly introduced (e.g., Wheeler and Henry, 1992). No subsequent studies have dealt with the species Knight placed in *Phymatopsallus*.

Knight (1964) illustrated the left and right parameres of 14 of the nominal species he placed in *Phymatopsallus*. Examination of specimens originally studied by him indicates that he dissected some of them, although he commented in his treatment that genitalic structures in some species were illustrated "without dissection". Knight (1964) indicated in his diagnoses that his species could be distinguished by their distinctive genitalic structure, and he clearly used those structures to relate species in a way congruent with several of the groupings I recognize below as new genera. Extensive dissection and more detailed examination of the male genitalia suggest that the species placed in *Phymatop-*

sallus by Knight belong to a monophyletic group, but that Knight's characterization of the group is in need of refinement and clarification.

Although Knight (1964) implicitly recognized several monophyletic species groups on the basis of distinctive structural features in the left paramere, he did not say explicitly which structures were distinctive to each of those groups. My studies of the genitalia suggest that, whereas the left paramere possesses variability useful in forming groupings of species, as for example *Phymatopsallus* sensu stricto, it is only through examination of the vesica that species can be accurately distinguished. This assertion is borne out by examination of the rather lengthy synonymy under *Phymatopsallus tuberculatus* (Van Duzee). Although the vesica seems to possess a limited number of features useful for grouping species, the phallotheca, on the other hand, is structurally most diverse, offering features that support the recognition of several monophyletic groupings. Knight (1964) did not incorporate the structure of the phallotheca into his commentary on relationships, probably because the diversity of its structure can only be appreciated upon dissection.

Since the publication of Knight's (1964) revision, significant amounts of new material and host data have become available. These data have broadened the known range and diversity for all taxa concerned and allow for further testing of Knight's theories concerning host relationships in the *Phymatopsallus* group. Nonetheless, even with the great increase in the number of specimens available for study, some taxa are still represented by one or a few collection events, and, consequently, limited host data.

The present paper provides a revision of *Phymatopsallus* sensu Knight (1964), a group of taxa endemic to the American Southwest and northern Mexico. Nine new genera and 15 new species are described, including one new genus-group taxon as an outgroup. Four species described by Van Duzee, but not included in the work of Knight, are newly treated as belonging to the group, which now comprises 9 genera and 29 species. A cladistic analysis is presented, as are analyses and discussions of distributional patterns and host associations.

MATERIALS AND METHODS

During the course of this research project, matrix code labels were affixed to most specimens examined as a way to uniquely identify them; these codes are therefore referred to as "unique specimen identifiers" (USIs). The USI codes, for example AMNH_PBI 00094810, which comprise an institution and project code (AMNH_PBI) and a unique number (00094810), are provided for all specimens examined during the process of preparing this paper. USI codes are included in the locality data, in the figure captions for genitalic illustrations, and in the appendix for the habitus images in figures 1–3.

Data listed in the "specimens examined" section of the present paper are sometimes transformed from what was found on the original labels. Most important in this case is the georeferencing of localities, because most of the specimen labels did not originally contain coordinates. For holotypes of previously described taxa, square brackets are used to enclose data that did not appear on the original labels. All latitude-longitude data are presented in degrees and decimal parts thereof. Altitude data are treated as metric. Please refer to the website of the Planetary Biodiversity Inventory Project on Plant Bugs [http://research.amnh.org/pbi] for additional information on specimens examined.

All measurements are in millimeters and were made using a micrometer driven stage, micrometer output being written directly to a spreadsheet.

Habitus photos are proportional to the size of the actual specimens so that relative sizes can be deduced from comparison of the specimen images. Actual sizes of specimens for each species can be determined by referring to table 1.

Terminology used for genitalic structures is given in figure 5. Additional information on the structure and terminology applied to the male genitalia can be found in Kelton (1959), Kerzhner and Konstantinov (1999), and Konstantinov (2003). The works of Slater (1950) and Davis (1955) are useful sources for the female genitalia. Illustrations of genitalic structures in the present paper are reproduced such that the proportional sizes of structures across taxa can be determined

by comparison of illustrations. The vesicae of some *Bisulcopsallus* and *Ceratopsallus* spp. are reduced 50% from those of other taxa because of their very large size; this fact is indicated in the figure caption by the phrase "vesica drawn at 50% scale". The following conventions are followed in preparing genitalic illustrations:

Vesica: Always drawn as viewed from the left side. In some *Bisulcopsallus* spp. the vesica consistently becomes distorted upon treatment in KOH and subsequent dissection. Consequently, the conformation of the vesica as seen in the undissected specimen is not reproduced in the illustrations; in all other cases the vesica remains undistorted (or nearly so) in the illustrations.

Phallotheca: Always drawn from the posterior view, unless otherwise indicated.

Left paramere: Always drawn from the anterior view, except in the case of *Ceratopsallus* spp., where a dorsal view is also presented.

Right paramere: Always drawn in dorsal view.

Female genitalic structures: Drawn in dorsal view unless otherwise indicated.

Illustrations incorporate the use of solid black arrows to indicate characteristics diagnostic for genera and white-filled arrows to indicate characteristics diagnostic for species. Lines, instead of arrows, are used to indicate terminology applied in the present paper. In some cases I have illustrated multiple specimens to better convey the type of variation seen when examining dissections within *Phymatopsallus*-group species. Approximately 300 dissections were prepared for the more than 3000 specimens examined during the course of this study.

PHYMATOPSALLUS GENUS GROUP

DIAGNOSIS: Recognized by the elongate, nearly parallel-sided right paramere with two more or less pronounced apical projections (figs. 5, 12, 14) and the marmorate membrane (figs. 1–3). All species green, pale, or sometimes weakly pink or red (figs. 1–3). Vesica formed of a single sclerotized strap in the form of a gutter, enclosed by a membrane on one side (figs. 5, 10, 15, 31). Some species with one or more of the following: tubercle on left side of pygophore (figs. 6E, F, 13E, F, 29E), yellow, orange, or green spots on the dorsum (figs. 1–3), and one or more spinelike projections on the phallotheca (figs. 5, 18, 32, 39). The pair of apical projections on the right paramere is similar to the condition seen in *Europiella* Reuter, but that taxon sharing few other structural features in common with *Phymatopsallus*-group taxa. The slender vesica formed of a single strap similar to that of *Atractotomus* Fieber, *Megalopsallus* Knight, and other genera, but those taxa lacking the distinctive right paramere and the marmorate membrane. Patch of setae (and often tubercle) on left side of pygophore possibly confused with the condition found in *Phallospinophylus* Weirauch (2006) and *Pygovepres* Weirauch (2006), but those taxa lacking other features diagnostic of *Phymatopsallus*-group, including the marmorate membrane and the distinctive right paramere.

DISCUSSION: The form of the right paramere, which was first commented on by Van Duzee (1917) and later by Knight (1964), appears to be distinctive for the group of taxa here placed in the *Phymatopsallus* group of genera. Although the structure of the right paramere might be deemed sufficient to maintain *Phymatopsallus* sensu Knight, the resulting group is heterogeneous on the basis of other characters, such as the presence of a tubercle on the left side of the pygophore, which was viewed as diagnostic by Knight. Thus, I have chosen to diagnose genera on a more restricted basis, which allows groups to be formed on the basis of characters that show less homoplasy. This approach also permits the incorporation of taxa that do not possess the tubercle on the pygophore and that also show variability in other characters, such as coloration, but which on the basis of phylogenetic analysis, nonetheless appear to be embedded in the larger monophyletic group recognized by Knight (1964).

KEY TO MALES OF *PHYMATOPSALLUS*-GROUP GENERA AND *SCHAFFNEROPSALLUS*

1. Pygophore without a raised tubercle on left side (fig. 27F), although sometimes with a patch of differentiated setae (fig. 24D, F) 2

– Pygophore with a distinct, raised, tubercle on left side; tubercle covered apically with erect setae (figs. 6E, F, 13E, F, 29E) . . 6
2. Pygophore with a patch of short, stout, spinelike setae on left side (fig. 24D, F) . . . . . *Cercocarpopsallus*, new genus
– Pygophore lacking patch of differentiated setae on left side 3
3. Dorsum more or less uniformly covered with brownish spots. 4
– Dorsum unicolorous green, often turning yellowish in preserved specimens (fig. 3, *Phymatopsallus* spp.) 5
4. Phallotheca with two hornlike projections on apicodorsal surface, indicated by arrows in figure 39 (see also fig. 38H); smaller, total length never more than 2.84 . . . . . *Stictopsallus*, new genus
– Phallotheca without hornlike projections on apicodorsal surface (fig. 5); relatively larger, total length greater than 2.88 . . . . . *Arizonapsallus*, new genus
5. Antennal segment 2 slightly tapered, not of uniform diameter over entire length; eyes relatively small (figs. 1, 4A), occupying about two-thirds height of head in lateral view (fig. 4A); right paramere parallel-sided, conspicuously elongate, apex nearly as broad as midpoint (fig. 5); phallotheca with slender spine on ventral surface (fig. 5) . . . . . *Angelopsallus*, new genus
– Antennal segment 2 of uniform diameter over entire length (fig. 27D); eyes relatively large (fig. 3), occupying nearly entire height of head in lateral view; right paramere not strongly parallel-sided, narrower at apex than midpoint (fig. 28); phallotheca with thumblike, apically attenuated spine on anterior surface (fig. 28) . . . . . *Knightopsallus*, new genus
6. Dorsum always unicolorous green, although sometimes yellowish in preserved specimens (fig. 3, *Phymatopsallus* spp.); left paramere with a distinct thumblike projection on the dorsal margin of the anterior surface (figs. 29E, F, 30–34), anterior process simple (figs. 30–34); vesica with a slender, medial spine (figs. 30–34) . . . . . *Phymatopsallus* Knight
– Dorsum usually covered, at least on hemelytra, with small spots contrasting with background coloration, although rarely of restricted distribution or absent; anterior surface of left paramere simple; vesica without medial spine 7
7. Pygophore relatively small, conical; anterior process of left paramere simple (fig. 41), lacking ornamentation as described below . . . . . *Schaffneropsallus*, new genus
– Pygophore large, broad over much of length (figs. 6E, F, 13E); anterior process of left paramere either bifid apically or in shape of "cow horns" (figs. 7–12, 14–23) 8
8. Left paramere with anterior process bifid apically (figs. 7–12) . . . . . *Bisulcopsallus*, new genus
– Left paramere with anterior process in shape of cow horns (figs. 14–23) . . . . . *Ceratopsallus*, new genus

Angelopsallus, new genus

Type species: *Psallus gregalis* Van Duzee, 1923.

DIAGNOSIS: Recognized by the relatively small size among *Phymatopsallus*-group taxa, average total length 2.32, whitish coloration (according to Van Duzee, 1923) (fig. 1), the lack of sexual dimorphism in the eyes and antennae, the absence of a tubercle on the left side of the pygophore, the relatively short, slender spine on the ventral surface of the phallotheca (fig. 5), the elongate vesica lacking ornamenation (fig. 5), and the elongate, flattened, parallel-sided right paramere (fig. 5). Most readily confused with *Knightopsallus portalensis* Schuh, but distinguished by the larger, sexually dimorphic eyes and cylindrical antennal segment 2 in that species (fig. 27D); in addition, details of male genitalic scructure differ, *K. portalensis* with a relatively broad spine on the posterior surface of the phallotheca and a moderately elongate, apically tapered right paramere (fig. 28), in contrast to the ventral phallothecal spine and less conspicuously elongate, strongly parallel-sided right paramere in *Angelopsallus* (fig. 5). Also confused with *Phymatopsallus* species because of the similar size and conformation of the body; however, males readily distinguished by the differences in the form of the phallothecal spines in the two taxa and the absence of the vesical spine in *Angelopsallus*.

DESCRIPTION: *Male:* Relatively small among *Phymatopsallus*-group taxa, elongate ovoid, total length 2.25–2.38, length apex clypeus–cuneal fracture 1.61–1.64, width pronotum 0.72–0.78. COLORATION (fig. 1): Body and forewings whitish (Van Duzee, 1923); membrane weakly marmorate, veins pale; eyes silvery or pale; appendages pale,

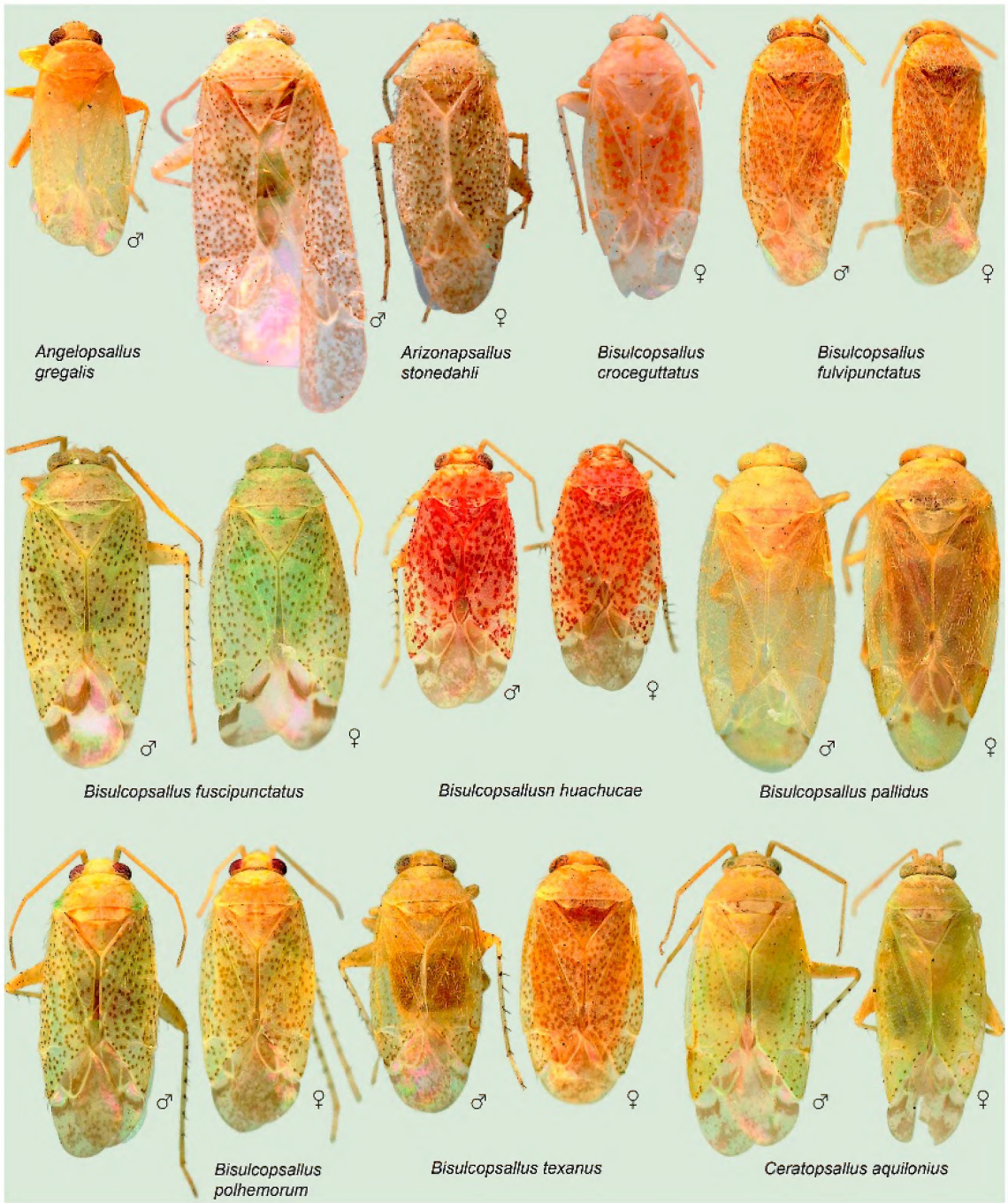


Fig. 1. Habitus views of *Phymatopsallus*-group taxa: *Angelopsallus*, *Arizonapsallus*, *Bisulcopsallus*, *Ceratopsallus aquilonius* (see appendix for specimens examined).

weakly yellowish; femora with scattered weak brown spots; tibial spines pale, with small weakly brown spots at bases. SURFACE AND VESTITURE (fig. 1): Dorsal body surface smooth, impunctate, weakly shining. Dorsal vestiture of reclining, silvery, sericeous setae. STRUCTURE: Head: Head short, transverse, closely conforming

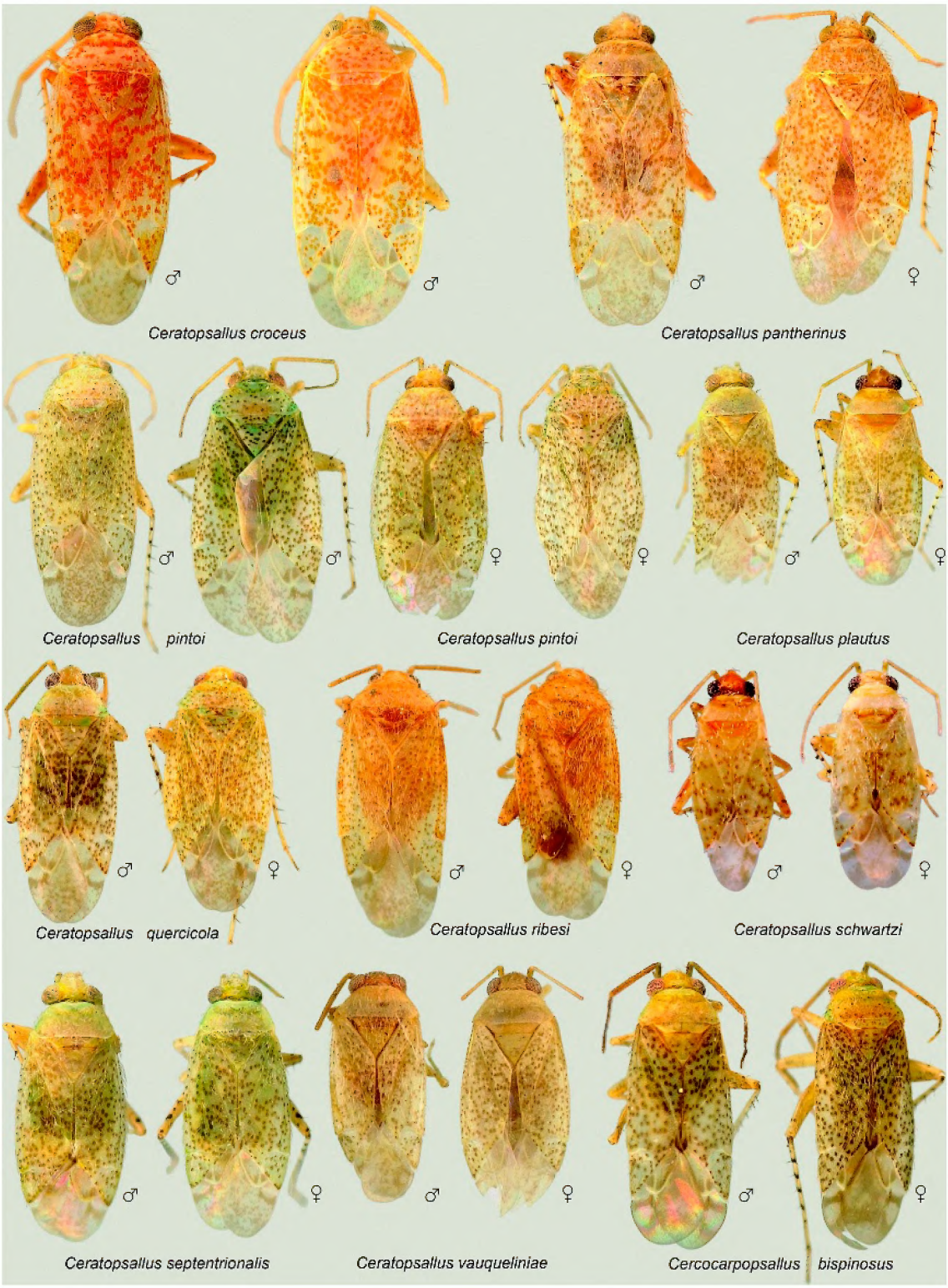


Fig. 2. Habitus views of *Phymatopsallus*-group taxa: *Ceratopsallus croceus–Ceratopsallus vauqueliniae*, *Cercocarpopsallus bispinosus* (see appendix for specimens examined).

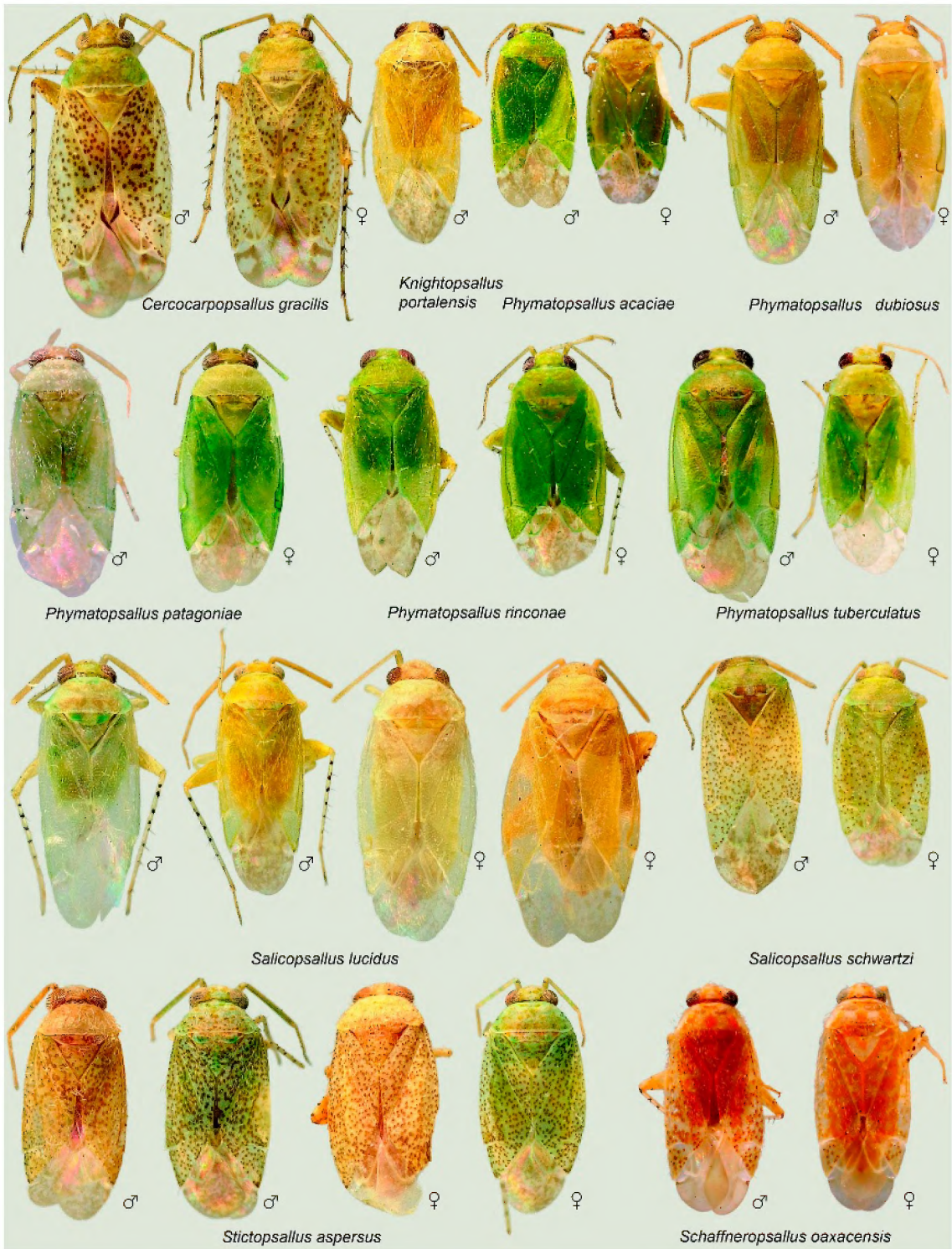


Fig. 3. Habitus views of *Phymatopsallus*-group taxa: *Cercocarpopsallus gracilis*, *Knightopsallus*, *Phymatopsallus*, *Salicopsallus*, *Stictopsallus*, *Schaffneropsallus* (see appendix for specimens examined).

TABLE 1
Measurements of *Phymatopsallus*-Group Species

		Length						Width				
		Body	CunClyp	Head	Pron	Scut	Cun	Head	Pron	Scut	InterOc	AntSeg2
Angelopsallus												
A. gregalis												
M (N = 3)	**Mean**	**2.32**	**1.63**	**0.22**	**0.31**	**0.27**	**0.35**	**0.55**	**0.75**	**0.35**	**0.30**	**0.54**
	SD	0.07	0.02	0.05	0.01	0.04	0.03	0.01	0.03	0.03	0.02	0.00
	Range	0.13	0.04	0.10	0.02	0.07	0.06	0.02	0.06	0.06	0.03	0.01
	Min	2.25	1.61	0.18	0.30	0.25	0.32	0.54	0.72	0.31	0.28	0.53
	Max	2.38	1.64	0.28	0.32	0.31	0.39	0.56	0.78	0.38	0.31	0.54
F (N = 3)	**Mean**	**2.35**	**1.66**	**0.18**	**0.28**	**0.30**	**0.34**	**0.55**	**0.78**	**0.39**	**0.30**	**0.56**
	SD	0.05	0.02	0.02	0.02	0.02	0.02	0.02	0.04	0.02	0.01	0.01
	Range	0.10	0.03	0.05	0.04	0.04	0.04	0.03	0.07	0.05	0.02	0.01
	Min	2.30	1.64	0.16	0.26	0.29	0.32	0.54	0.73	0.36	0.29	0.55
	Max	2.41	1.67	0.21	0.30	0.33	0.36	0.57	0.81	0.41	0.31	0.56
Arizonapsallus												
A. stonedahli												
M (N = 4)	**Mean**	**3.56**	**2.24**	**0.18**	**0.37**	**0.40**	**0.60**	**0.63**	**0.96**	**0.48**	**0.37**	**0.94**
	SD	0.11	0.07	0.02	0.02	0.03	0.06	0.02	0.04	0.01	0.02	0.02
	Range	0.23	0.16	0.05	0.05	0.06	0.13	0.03	0.09	0.03	0.04	0.04
	Min	3.48	2.17	0.16	0.35	0.38	0.55	0.60	0.92	0.46	0.34	0.93
	Max	3.71	2.33	0.21	0.40	0.44	0.68	0.64	1.00	0.50	0.38	0.97
F (N = 5)	**Mean**	**2.93**	**2.02**	**0.22**	**0.35**	**0.34**	**0.45**	**0.61**	**0.93**	**0.45**	**0.37**	**0.76**
	SD	0.05	0.03	0.02	0.02	0.03	0.07	0.01	0.02	0.03	0.02	0.04
	Range	0.13	0.08	0.05	0.04	0.09	0.17	0.04	0.05	0.06	0.06	0.09
	Min	2.88	1.99	0.20	0.33	0.31	0.40	0.59	0.90	0.42	0.34	0.73
	Max	3.01	2.07	0.25	0.37	0.40	0.57	0.63	0.96	0.48	0.40	0.82
Bisulcopsallus												
B. croceguttatus												
F (N = 1)	**Data**	**3.24**	**2.29**	**0.22**	**0.37**	**0.47**	**0.46**	**0.66**	**1.03**	**0.70**	**0.35**	**0.86**
B. fulvipunctatus												
M (N = 3)	**Mean**	**2.68**	**1.85**	**0.17**	**0.37**	**0.36**	**0.39**	**0.66**	**0.92**	**0.47**	**0.34**	**0.64**
	SD	0.12	0.01	0.02	0.01	0.04	0.01	0.01	0.01	0.03	0.03	0.06
	Range	0.24	0.02	0.03	0.01	0.07	0.02	0.02	0.03	0.06	0.05	0.11
	Min	2.55	1.83	0.15	0.36	0.32	0.38	0.65	0.91	0.44	0.32	0.56
	Max	2.79	1.85	0.18	0.38	0.39	0.40	0.67	0.93	0.50	0.37	0.67
F (N = 3)	**Mean**	**2.69**	**1.80**	**0.17**	**0.34**	**0.36**	**0.45**	**0.65**	**0.92**	**0.49**	**0.35**	**0.62**
	SD	0.21	0.19	0.03	0.06	0.01	0.07	0.01	0.04	0.02	0.01	0.05
	Range	0.41	0.37	0.07	0.11	0.01	0.14	0.02	0.07	0.03	0.02	0.10
	Min	2.52	1.59	0.14	0.27	0.35	0.38	0.64	0.88	0.48	0.34	0.58
	Max	2.93	1.96	0.21	0.38	0.36	0.53	0.66	0.95	0.51	0.35	0.67
B. fuscipunctatus												
M (N = 10)	**Mean**	**3.24**	**2.11**	**0.18**	**0.37**	**0.42**	**0.55**	**0.67**	**1.02**	**0.54**	**0.35**	**0.81**
	SD	0.16	0.10	0.04	0.02	0.02	0.05	0.03	0.04	0.02	0.02	0.05
	Range	0.49	0.35	0.12	0.06	0.06	0.16	0.11	0.12	0.08	0.08	0.17
	Min	2.91	1.97	0.14	0.34	0.39	0.48	0.61	0.94	0.49	0.31	0.74
	Max	3.40	2.32	0.27	0.39	0.45	0.63	0.72	1.06	0.57	0.39	0.91
F (N = 10)	**Mean**	**3.08**	**2.06**	**0.18**	**0.36**	**0.41**	**0.48**	**0.66**	**0.98**	**0.52**	**0.34**	**0.75**
	SD	0.14	0.08	0.06	0.03	0.03	0.04	0.03	0.05	0.04	0.02	0.04
	Range	0.39	0.27	0.18	0.11	0.12	0.12	0.08	0.18	0.12	0.05	0.12
	Min	2.83	1.95	0.14	0.31	0.34	0.42	0.62	0.87	0.47	0.32	0.67
	Max	3.22	2.22	0.32	0.41	0.46	0.54	0.70	1.05	0.58	0.37	0.79

TABLE 1
(Continued)

		Length						Width				
		Body	CunClyp	Head	Pron	Scut	Cun	Head	Pron	Scut	InterOc	AntSeg2
Bisulcopsallus *(continued)*												
B. huachucae												
M (N = 8)	**Mean**	**2.64**	**1.82**	**0.18**	**0.35**	**0.36**	**0.39**	**0.63**	**0.89**	**0.48**	**0.31**	**0.65**
	SD	0.14	0.12	0.05	0.03	0.03	0.05	0.02	0.05	0.07	0.01	0.06
	Range	0.40	0.30	0.15	0.08	0.09	0.17	0.06	0.14	0.22	0.05	0.21
	Min	2.44	1.67	0.11	0.31	0.32	0.31	0.60	0.82	0.41	0.28	0.50
	Max	2.83	1.97	0.26	0.39	0.41	0.48	0.65	0.96	0.64	0.34	0.71
F (N = 5)	**Mean**	**2.49**	**1.73**	**0.17**	**0.33**	**0.32**	**0.33**	**0.63**	**0.88**	**0.46**	**0.35**	**0.62**
	SD	0.13	0.07	0.05	0.02	0.03	0.04	0.03	0.02	0.04	0.04	0.06
	Range	0.33	0.16	0.12	0.05	0.06	0.10	0.07	0.04	0.09	0.09	0.14
	Min	2.28	1.66	0.13	0.31	0.27	0.27	0.60	0.86	0.43	0.31	0.52
	Max	2.61	1.81	0.26	0.36	0.34	0.37	0.67	0.90	0.51	0.40	0.66
B. pallidus												
M (N = 4)	**Mean**	**3.31**	**2.29**	**0.20**	**0.41**	**0.45**	**0.57**	**0.71**	**1.08**	**0.56**	**0.37**	**0.94**
	SD	0.13	0.13	0.03	0.06	0.01	0.05	0.02	0.01	0.02	0.02	0.02
	Range	0.31	0.28	0.06	0.12	0.03	0.12	0.05	0.03	0.04	0.05	0.04
	Min	3.19	2.10	0.17	0.32	0.44	0.52	0.68	1.07	0.53	0.34	0.92
	Max	3.50	2.38	0.23	0.44	0.47	0.64	0.73	1.10	0.58	0.39	0.96
F (N = 4)	**Mean**	**3.30**	**2.25**	**0.17**	**0.42**	**0.43**	**0.57**	**0.71**	**1.13**	**0.60**	**0.38**	**0.93**
	SD	0.08	0.11	0.07	0.05	0.01	0.03	0.02	0.02	0.02	0.03	0.03
	Range	0.18	0.24	0.15	0.11	0.03	0.08	0.05	0.06	0.04	0.05	0.07
	Min	3.23	2.17	0.12	0.38	0.41	0.53	0.68	1.10	0.58	0.35	0.90
	Max	3.41	2.41	0.27	0.49	0.44	0.61	0.74	1.16	0.62	0.41	0.97
B. polhemorum												
M (N = 5)	**Mean**	**3.02**	**2.06**	**0.22**	**0.39**	**0.38**	**0.40**	**0.66**	**1.00**	**0.52**	**0.34**	**0.75**
	SD	0.21	0.09	0.06	0.04	0.03	0.04	0.02	0.05	0.04	0.03	0.06
	Range	0.52	0.23	0.16	0.11	0.07	0.11	0.06	0.13	0.11	0.08	0.15
	Min	2.70	1.91	0.16	0.32	0.35	0.36	0.63	0.91	0.47	0.29	0.65
	Max	3.21	2.14	0.32	0.42	0.42	0.47	0.69	1.04	0.58	0.37	0.80
F (N = 5)	**Mean**	**2.91**	**1.98**	**0.16**	**0.35**	**0.38**	**0.41**	**0.66**	**0.97**	**0.48**	**0.35**	**0.72**
	SD	0.12	0.05	0.06	0.04	0.03	0.04	0.01	0.03	0.03	0.03	0.05
	Range	0.27	0.12	0.14	0.12	0.09	0.11	0.03	0.07	0.08	0.07	0.10
	Min	2.77	1.90	0.09	0.28	0.33	0.35	0.64	0.94	0.44	0.31	0.68
	Max	3.04	2.01	0.22	0.39	0.42	0.46	0.67	1.02	0.52	0.38	0.77
B. texanus												
M (N = 5)	**Mean**	**2.72**	**1.86**	**0.18**	**0.35**	**0.39**	**0.44**	**0.67**	**0.93**	**0.50**	**0.33**	**0.69**
	SD	0.07	0.09	0.06	0.04	0.02	0.07	0.02	0.05	0.02	0.01	0.09
	Range	0.16	0.24	0.16	0.11	0.06	0.19	0.05	0.13	0.05	0.03	0.23
	Min	2.62	1.74	0.10	0.29	0.36	0.35	0.64	0.87	0.49	0.31	0.57
	Max	2.78	1.98	0.25	0.40	0.41	0.54	0.69	1.00	0.54	0.34	0.79
F (N = 4)	**Mean**	**2.65**	**1.80**	**0.17**	**0.35**	**0.36**	**0.46**	**0.63**	**0.92**	**0.48**	**0.32**	**0.73**
	SD	0.16	0.05	0.01	0.02	0.05	0.01	0.01	0.01	0.04	0.01	0.10
	Range	0.36	0.12	0.03	0.04	0.11	0.02	0.03	0.03	0.08	0.03	0.20
	Min	2.45	1.75	0.16	0.32	0.30	0.45	0.62	0.90	0.43	0.31	0.59
	Max	2.81	1.87	0.19	0.36	0.41	0.48	0.64	0.94	0.51	0.34	0.79
Ceratopsallus												
C. aquilonius												
M (N = 7)	**Mean**	**3.06**	**2.07**	**0.19**	**0.36**	**0.39**	**0.49**	**0.65**	**0.91**	**0.49**	**0.36**	**0.82**
	SD	0.22	0.12	0.06	0.03	0.04	0.05	0.02	0.08	0.04	0.03	0.08
	Range	0.57	0.30	0.18	0.08	0.13	0.12	0.05	0.21	0.11	0.08	0.21
	Min	2.81	1.91	0.12	0.32	0.34	0.45	0.62	0.77	0.42	0.32	0.69
	Max	3.37	2.21	0.30	0.40	0.47	0.57	0.67	0.98	0.54	0.40	0.90

TABLE 1
(Continued)

		Length						Width				
		Body	CunClyp	Head	Pron	Scut	Cun	Head	Pron	Scut	InterOc	AntSeg2
***Ceratopsallus* (continued)**												
***C. aquilonius* (continued)**												
F (N = 6)	**Mean**	**3.01**	**2.08**	**0.19**	**0.36**	**0.39**	**0.46**	**0.66**	**0.95**	**0.48**	**0.35**	**0.81**
	SD	0.22	0.15	0.03	0.04	0.04	0.04	0.03	0.09	0.05	0.03	0.08
	Range	0.46	0.37	0.08	0.12	0.11	0.13	0.08	0.22	0.13	0.08	0.21
	Min	2.73	1.88	0.14	0.30	0.35	0.39	0.62	0.84	0.42	0.32	0.68
	Max	3.18	2.25	0.23	0.42	0.46	0.51	0.70	1.06	0.55	0.39	0.89
C. croceus												
M (N = 6)	**Mean**	**3.43**	**2.39**	**0.18**	**0.41**	**0.46**	**0.51**	**0.77**	**1.12**	**0.58**	**0.37**	**1.22**
	SD	0.20	0.11	0.03	0.03	0.03	0.05	0.04	0.08	0.05	0.02	0.13
	Range	0.55	0.29	0.09	0.07	0.07	0.14	0.12	0.21	0.13	0.06	0.32
	Min	3.15	2.19	0.13	0.37	0.41	0.46	0.70	0.98	0.48	0.35	0.98
	Max	3.70	2.48	0.21	0.44	0.48	0.59	0.83	1.19	0.62	0.41	1.30
F (N = 2)	**Mean**	**3.03**	**2.17**	**0.23**	**0.42**	**0.37**	**0.45**	**0.70**	**0.98**	**0.51**	**0.37**	**0.82**
	SD	0.00	0.08	0.05	0.03	0.01	0.05	0.03	0.03	0.00	0.01	0.09
	Range	0.00	0.11	0.07	0.04	0.02	0.08	0.04	0.05	0.00	0.02	0.12
	Min	3.03	2.11	0.19	0.40	0.36	0.41	0.68	0.96	0.51	0.37	0.76
	Max	3.03	2.22	0.26	0.44	0.38	0.49	0.72	1.01	0.52	0.38	0.88
C. pantherinus												
M (N = 3)	**Mean**	**3.48**	**2.28**	**0.21**	**0.39**	**0.44**	**0.56**	**0.70**	**1.07**	**0.57**	**0.38**	**0.90**
	SD	0.07	0.04	0.02	0.02	0.01	0.03	0.01	0.02	0.02	0.01	0.01
	Range	0.13	0.09	0.03	0.03	0.03	0.05	0.02	0.05	0.05	0.01	0.02
	Min	3.42	2.23	0.19	0.37	0.43	0.53	0.69	1.05	0.55	0.37	0.89
	Max	3.55	2.32	0.22	0.40	0.46	0.58	0.70	1.09	0.59	0.38	0.91
F (N = 2)	**Mean**	**3.06**	**2.08**	**0.20**	**0.41**	**0.40**	**0.41**	**0.65**	**0.94**	**0.50**	**0.31**	**0.82**
	SD	0.06	0.03	0.01	0.04	0.01	0.07	0.01	0.02	0.00	0.02	0.03
	Range	0.08	0.05	0.01	0.05	0.02	0.11	0.01	0.03	0.01	0.02	0.04
	Min	3.02	2.06	0.19	0.38	0.39	0.35	0.64	0.92	0.50	0.30	0.80
	Max	3.10	2.10	0.21	0.43	0.41	0.46	0.65	0.96	0.50	0.32	0.83
C. pintoi												
M (N = 14)	**Mean**	**3.00**	**2.04**	**0.19**	**0.37**	**0.37**	**0.45**	**0.64**	**0.93**	**0.48**	**0.34**	**0.73**
	SD	0.26	0.14	0.04	0.02	0.04	0.06	0.03	0.04	0.03	0.03	0.08
	Range	0.96	0.48	0.13	0.07	0.12	0.17	0.11	0.16	0.10	0.09	0.31
	Min	2.50	1.76	0.13	0.35	0.28	0.36	0.57	0.86	0.42	0.29	0.62
	Max	3.47	2.24	0.25	0.42	0.41	0.54	0.68	1.02	0.51	0.38	0.93
F (N = 10)	**Mean**	**2.86**	**2.00**	**0.23**	**0.37**	**0.36**	**0.40**	**0.64**	**0.90**	**0.46**	**0.35**	**0.71**
	SD	0.23	0.15	0.04	0.02	0.03	0.05	0.02	0.06	0.04	0.03	0.06
	Range	0.71	0.45	0.11	0.07	0.08	0.17	0.06	0.13	0.12	0.09	0.15
	Min	2.52	1.79	0.17	0.33	0.31	0.30	0.61	0.85	0.41	0.31	0.61
	Max	3.24	2.24	0.28	0.41	0.39	0.47	0.67	0.98	0.53	0.39	0.77
C. plautus												
M (N = 5)	**Mean**	**2.74**	**1.84**	**0.21**	**0.33**	**0.30**	**0.41**	**0.61**	**0.79**	**0.41**	**0.35**	**0.81**
	SD	0.13	0.06	0.03	0.02	0.02	0.03	0.03	0.02	0.03	0.02	0.03
	Range	0.30	0.15	0.08	0.04	0.06	0.08	0.07	0.04	0.07	0.07	0.07
	Min	2.56	1.75	0.17	0.31	0.26	0.36	0.58	0.77	0.38	0.31	0.77
	Max	2.87	1.90	0.25	0.35	0.32	0.44	0.65	0.81	0.45	0.38	0.84
F (N = 5)	**Mean**	**2.80**	**1.92**	**0.22**	**0.33**	**0.35**	**0.40**	**0.60**	**0.82**	**0.44**	**0.16**	**0.80**
	SD	0.09	0.05	0.03	0.02	0.01	0.05	0.03	0.02	0.02	0.36	0.03
	Range	0.24	0.11	0.07	0.05	0.02	0.11	0.08	0.05	0.04	0.81	0.07
	Min	2.68	1.87	0.19	0.30	0.34	0.35	0.55	0.79	0.41	-0.48	0.77
	Max	2.92	1.98	0.26	0.35	0.36	0.46	0.63	0.84	0.45	0.34	0.84

TABLE 1
(Continued)

		Length						Width				
		Body	CunClyp	Head	Pron	Scut	Cun	Head	Pron	Scut	InterOc	AntSeg2
***Ceratopsallus* (continued)**												
C. quercicola												
M (N = 6)	**Mean**	**2.89**	**1.95**	**0.21**	**0.35**	**0.37**	**0.40**	**0.65**	**0.90**	**0.47**	**0.33**	**0.69**
	SD	0.05	0.05	0.03	0.02	0.02	0.04	0.01	0.03	0.02	0.02	0.05
	Range	0.14	0.14	0.08	0.06	0.05	0.09	0.03	0.07	0.07	0.04	0.12
	Min	2.83	1.88	0.17	0.31	0.34	0.36	0.63	0.86	0.44	0.32	0.62
	Max	2.97	2.02	0.24	0.37	0.39	0.46	0.66	0.93	0.51	0.35	0.74
F (N = 5)	**Mean**	**2.75**	**1.88**	**0.20**	**0.35**	**0.39**	**0.37**	**0.64**	**0.94**	**0.48**	**0.34**	**0.62**
	SD	0.10	0.07	0.03	0.02	0.03	0.03	0.01	0.09	0.02	0.01	0.10
	Range	0.23	0.19	0.08	0.03	0.08	0.09	0.03	0.21	0.05	0.03	0.29
	Min	2.64	1.79	0.16	0.33	0.34	0.32	0.62	0.87	0.46	0.32	0.48
	Max	2.87	1.98	0.25	0.36	0.42	0.41	0.66	1.08	0.50	0.35	0.77
C. ribesi												
M (N = 4)	**Mean**	**3.10**	**2.05**	**0.14**	**0.35**	**0.43**	**0.47**	**0.68**	**1.01**	**0.53**	**0.35**	**0.79**
	SD	0.03	0.03	0.03	0.03	0.02	0.04	0.02	0.02	0.02	0.03	0.01
	Range	0.06	0.06	0.07	0.08	0.06	0.09	0.04	0.06	0.04	0.07	0.03
	Min	3.07	2.03	0.11	0.32	0.40	0.43	0.65	0.98	0.51	0.31	0.78
	Max	3.14	2.09	0.18	0.40	0.46	0.51	0.69	1.04	0.55	0.38	0.81
F (N = 2)	**Mean**	**2.77**	**1.84**	**0.12**	**0.31**	**0.37**	**0.38**	**0.65**	**0.95**	**0.49**	**0.32**	**0.70**
	SD	0.06	0.01	0.02	0.01	0.00	0.07	0.02	0.03	0.00	0.02	0.02
	Range	0.08	0.02	0.03	0.01	0.00	0.09	0.03	0.04	0.00	0.02	0.03
	Min	2.73	1.84	0.11	0.30	0.37	0.33	0.63	0.93	0.48	0.31	0.69
	Max	2.81	1.85	0.14	0.31	0.37	0.43	0.66	0.97	0.49	0.33	0.72
C. schwartzi												
M (N = 5)	**Mean**	**2.49**	**1.68**	**0.21**	**0.29**	**0.30**	**0.33**	**0.54**	**0.68**	**0.37**	**0.31**	**0.74**
	SD	0.07	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.02	0.01	0.04
	Range	0.16	0.06	0.05	0.05	0.04	0.07	0.06	0.07	0.04	0.03	0.09
	Min	2.41	1.66	0.18	0.28	0.28	0.31	0.51	0.65	0.36	0.29	0.71
	Max	2.57	1.72	0.23	0.33	0.32	0.38	0.58	0.72	0.39	0.32	0.80
F (N = 4)	**Mean**	**2.56**	**1.79**	**0.23**	**0.30**	**0.31**	**0.33**	**0.56**	**0.75**	**0.38**	**0.32**	**0.79**
	SD	0.20	0.13	0.05	0.02	0.03	0.04	0.03	0.07	0.04	0.02	0.03
	Range	0.45	0.30	0.10	0.05	0.06	0.09	0.08	0.15	0.09	0.06	0.08
	Min	2.39	1.68	0.19	0.28	0.27	0.29	0.53	0.71	0.36	0.30	0.75
	Max	2.84	1.98	0.29	0.33	0.34	0.38	0.61	0.86	0.45	0.35	0.83
C. septentrionalis												
M (N = 5)	**Mean**	**2.97**	**2.08**	**0.27**	**0.35**	**0.38**	**0.40**	**0.64**	**0.90**	**0.48**	**0.35**	**0.79**
	SD	0.08	0.08	0.04	0.02	0.02	0.05	0.04	0.05	0.03	0.03	0.06
	Range	0.22	0.18	0.11	0.05	0.06	0.12	0.10	0.12	0.08	0.06	0.16
	Min	2.88	1.98	0.22	0.32	0.35	0.36	0.59	0.84	0.44	0.32	0.72
	Max	3.10	2.15	0.33	0.37	0.42	0.48	0.69	0.97	0.52	0.38	0.89
F (N = 5)	**Mean**	**2.89**	**1.98**	**0.23**	**0.34**	**0.35**	**0.44**	**0.62**	**0.88**	**0.46**	**0.34**	**0.77**
	SD	0.17	0.10	0.05	0.01	0.04	0.04	0.02	0.03	0.03	0.01	0.07
	Range	0.42	0.26	0.14	0.03	0.09	0.10	0.05	0.08	0.08	0.03	0.20
	Min	2.70	1.83	0.15	0.32	0.30	0.40	0.60	0.85	0.40	0.32	0.65
	Max	3.13	2.09	0.29	0.36	0.40	0.50	0.64	0.93	0.49	0.35	0.85
C. vauqueliniae												
M (N = 4)	**Mean**	**2.54**	**1.82**	**0.21**	**0.39**	**0.29**	**0.35**	**0.63**	**0.92**	**0.45**	**0.29**	**0.74**
	SD	0.05	0.05	0.06	0.02	0.04	0.01	0.03	0.03	0.02	0.02	0.07
	Range	0.10	0.10	0.12	0.05	0.09	0.02	0.08	0.07	0.04	0.04	0.16
	Min	2.52	1.79	0.16	0.36	0.24	0.33	0.58	0.89	0.44	0.28	0.64
	Max	2.61	1.89	0.28	0.41	0.33	0.36	0.66	0.96	0.47	0.32	0.81

TABLE 1
(Continued)

		Length						Width				
		Body	CunClyp	Head	Pron	Scut	Cun	Head	Pron	Scut	InterOc	AntSeg2
Ceratopsallus *(continued)*												
C. vauqueliniae *(continued)*												
F (N = 5)	**Mean**	**2.65**	**1.89**	**0.22**	**0.39**	**0.32**	**0.38**	**0.65**	**0.92**	**0.45**	**0.35**	**0.68**
	SD	0.10	0.05	0.05	0.02	0.02	0.05	0.02	0.03	0.02	0.02	0.03
	Range	0.21	0.12	0.13	0.06	0.06	0.10	0.04	0.08	0.04	0.04	0.08
	Min	2.54	1.82	0.14	0.36	0.28	0.32	0.63	0.88	0.43	0.33	0.63
	Max	2.76	1.94	0.27	0.42	0.34	0.42	0.67	0.97	0.46	0.37	0.71
Cercocarpopsallus												
C. bispinosus												
M (N = 6)	**Mean**	**3.07**	**2.16**	**0.22**	**0.41**	**0.37**	**0.46**	**0.66**	**0.99**	**0.51**	**0.37**	**0.83**
	SD	0.19	0.21	0.01	0.02	0.03	0.06	0.02	0.07	0.04	0.02	0.05
	Range	0.53	0.62	0.04	0.05	0.07	0.16	0.05	0.19	0.12	0.05	0.13
	Min	2.86	1.92	0.20	0.37	0.34	0.40	0.64	0.85	0.43	0.34	0.75
	Max	3.40	2.55	0.24	0.43	0.41	0.56	0.69	1.04	0.54	0.39	0.88
F (N = 5)	**Mean**	**3.09**	**2.08**	**0.21**	**0.40**	**0.38**	**0.44**	**0.64**	**0.96**	**0.51**	**0.37**	**0.86**
	SD	0.18	0.14	0.05	0.03	0.02	0.02	0.04	0.05	0.03	0.02	0.03
	Range	0.44	0.36	0.13	0.08	0.05	0.06	0.09	0.11	0.07	0.06	0.07
	Min	2.88	1.95	0.17	0.37	0.35	0.40	0.60	0.90	0.49	0.34	0.82
	Max	3.32	2.31	0.30	0.45	0.40	0.46	0.68	1.01	0.56	0.40	0.89
C. gracilis												
M (N = 5)	**Mean**	**3.14**	**2.07**	**0.20**	**0.40**	**0.39**	**0.48**	**0.64**	**0.95**	**0.49**	**0.35**	**0.78**
	SD	0.05	0.06	0.04	0.03	0.01	0.05	0.01	0.03	0.02	0.01	0.04
	Range	0.13	0.17	0.10	0.08	0.03	0.12	0.04	0.06	0.05	0.03	0.09
	Min	3.05	2.00	0.15	0.37	0.38	0.44	0.61	0.92	0.48	0.34	0.72
	Max	3.18	2.17	0.25	0.44	0.41	0.56	0.65	0.98	0.53	0.36	0.81
F (N = 4)	**Mean**	**2.99**	**2.11**	**0.23**	**0.40**	**0.39**	**0.42**	**0.66**	**0.97**	**0.50**	**0.38**	**0.84**
	SD	0.16	0.11	0.04	0.02	0.02	0.04	0.03	0.03	0.03	0.04	0.07
	Range	0.37	0.25	0.09	0.05	0.04	0.09	0.06	0.06	0.08	0.10	0.16
	Min	2.75	1.95	0.19	0.36	0.36	0.38	0.62	0.94	0.46	0.33	0.75
	Max	3.12	2.20	0.28	0.42	0.40	0.47	0.68	1.00	0.54	0.43	0.90
Knightopsallus												
K. portalensis												
M (N = 5)	**Mean**	**2.49**	**1.71**	**0.12**	**0.31**	**0.34**	**0.37**	**0.60**	**0.85**	**0.42**	**0.30**	**0.64**
	SD	0.22	0.12	0.03	0.03	0.04	0.05	0.01	0.02	0.03	0.01	0.05
	Range	0.53	0.29	0.07	0.07	0.10	0.12	0.03	0.05	0.07	0.04	0.12
	Min	2.17	1.49	0.08	0.27	0.28	0.30	0.59	0.82	0.38	0.28	0.58
	Max	2.70	1.78	0.15	0.34	0.38	0.42	0.61	0.87	0.45	0.32	0.70
Phymatopsallus												
P. acaciae												
M (N = 5)	**Mean**	**2.08**	**1.43**	**0.14**	**0.28**	**0.29**	**0.29**	**0.54**	**0.73**	**0.36**	**0.31**	**0.45**
	SD	0.12	0.06	0.02	0.02	0.03	0.04	0.02	0.04	0.02	0.01	0.02
	Range	0.26	0.16	0.04	0.05	0.08	0.11	0.06	0.10	0.05	0.04	0.05
	Min	1.92	1.34	0.12	0.25	0.25	0.23	0.52	0.68	0.33	0.30	0.42
	Max	2.17	1.50	0.16	0.31	0.33	0.33	0.58	0.78	0.38	0.33	0.47
F (N = 5)	**Mean**	**2.02**	**1.42**	**0.14**	**0.28**	**0.26**	**0.27**	**0.51**	**0.71**	**0.35**	**0.31**	**0.47**
	SD	0.08	0.05	0.02	0.02	0.02	0.02	0.01	0.03	0.01	0.01	0.02
	Range	0.20	0.13	0.06	0.04	0.05	0.04	0.03	0.07	0.02	0.02	0.06
	Min	1.95	1.38	0.11	0.26	0.24	0.24	0.49	0.66	0.35	0.30	0.44
	Max	2.15	1.52	0.17	0.30	0.29	0.28	0.52	0.73	0.37	0.32	0.50

TABLE 1
(Continued)

		Length						Width				
		Body	CunClyp	Head	Pron	Scut	Cun	Head	Pron	Scut	InterOc	AntSeg2
Phymatopsallus *(continued)*												
P. dubiosus												
M (N = 6)	**Mean**	**2.73**	**1.88**	**0.19**	**0.38**	**0.35**	**0.43**	**0.67**	**0.92**	**0.47**	**0.30**	**0.72**
	SD	0.11	0.08	0.03	0.02	0.02	0.02	0.01	0.04	0.03	0.03	0.04
	Range	0.27	0.22	0.08	0.06	0.05	0.06	0.04	0.12	0.08	0.07	0.11
	Min	2.53	1.72	0.15	0.35	0.32	0.40	0.65	0.86	0.43	0.26	0.68
	Max	2.80	1.94	0.23	0.41	0.37	0.46	0.69	0.98	0.50	0.33	0.79
F (N = 4)	**Mean**	**2.53**	**1.81**	**0.20**	**0.36**	**0.30**	**0.39**	**0.60**	**0.88**	**0.43**	**0.34**	**0.60**
	SD	0.12	0.05	0.03	0.03	0.04	0.03	0.03	0.04	0.04	0.02	0.05
	Range	0.29	0.11	0.06	0.06	0.09	0.07	0.06	0.09	0.10	0.05	0.10
	Min	2.36	1.76	0.17	0.32	0.26	0.35	0.57	0.83	0.38	0.31	0.56
	Max	2.66	1.87	0.23	0.38	0.35	0.42	0.63	0.92	0.48	0.36	0.66
P. patagoniae												
M (N = 6)	**Mean**	**2.77**	**1.89**	**0.20**	**0.38**	**0.35**	**0.44**	**0.66**	**0.91**	**0.46**	**0.33**	**0.72**
	SD	0.20	0.13	0.03	0.05	0.03	0.03	0.03	0.07	0.03	0.02	0.07
	Range	0.53	0.38	0.08	0.14	0.09	0.07	0.08	0.20	0.09	0.06	0.17
	Min	2.42	1.65	0.16	0.31	0.29	0.40	0.62	0.80	0.43	0.30	0.61
	Max	2.95	2.03	0.24	0.45	0.38	0.48	0.70	1.01	0.53	0.36	0.79
F (N = 6)	**Mean**	**2.67**	**1.88**	**0.21**	**0.38**	**0.34**	**0.39**	**0.63**	**0.89**	**0.45**	**0.33**	**0.66**
	SD	0.32	0.21	0.04	0.04	0.04	0.08	0.03	0.05	0.04	0.03	0.13
	Range	0.88	0.57	0.10	0.12	0.11	0.23	0.09	0.14	0.10	0.07	0.36
	Min	2.42	1.73	0.14	0.35	0.28	0.31	0.59	0.85	0.41	0.29	0.55
	Max	3.30	2.30	0.25	0.47	0.39	0.54	0.68	0.99	0.51	0.36	0.91
P. rinconae												
M (N = 11)	**Mean**	**2.53**	**1.72**	**0.15**	**0.34**	**0.35**	**0.37**	**0.62**	**0.86**	**0.45**	**0.29**	**0.64**
	SD	0.26	0.13	0.03	0.03	0.04	0.07	0.04	0.07	0.03	0.02	0.05
	Range	0.81	0.44	0.12	0.10	0.15	0.27	0.14	0.20	0.10	0.04	0.19
	Min	2.30	1.56	0.09	0.30	0.26	0.26	0.58	0.79	0.42	0.27	0.54
	Max	3.11	2.00	0.22	0.40	0.41	0.53	0.72	1.00	0.52	0.32	0.73
F (N = 11)	**Mean**	**2.49**	**1.69**	**0.15**	**0.32**	**0.34**	**0.37**	**0.59**	**0.86**	**0.45**	**0.31**	**0.62**
	SD	0.11	0.07	0.02	0.03	0.02	0.05	0.02	0.04	0.03	0.01	0.03
	Range	0.34	0.21	0.08	0.09	0.08	0.15	0.06	0.13	0.09	0.04	0.10
	Min	2.28	1.56	0.12	0.28	0.28	0.32	0.56	0.78	0.40	0.29	0.56
	Max	2.63	1.77	0.20	0.37	0.36	0.47	0.62	0.91	0.49	0.33	0.66
P. tuberculatus												
M (N = 10)	**Mean**	**2.72**	**1.85**	**0.18**	**0.35**	**0.37**	**0.40**	**0.64**	**0.92**	**0.48**	**0.30**	**0.69**
	SD	0.13	0.06	0.03	0.02	0.02	0.04	0.02	0.04	0.03	0.01	0.05
	Range	0.40	0.18	0.10	0.07	0.07	0.13	0.07	0.15	0.09	0.04	0.20
	Min	2.56	1.77	0.14	0.33	0.34	0.35	0.62	0.82	0.45	0.28	0.61
	Max	2.96	1.94	0.24	0.39	0.41	0.48	0.68	0.98	0.53	0.32	0.81
F (N = 10)	**Mean**	**2.56**	**1.77**	**0.17**	**0.34**	**0.35**	**0.38**	**0.61**	**0.88**	**0.45**	**0.32**	**0.63**
	SD	0.13	0.11	0.03	0.03	0.02	0.04	0.02	0.05	0.03	0.02	0.06
	Range	0.42	0.34	0.10	0.09	0.06	0.13	0.07	0.18	0.11	0.08	0.17
	Min	2.30	1.56	0.12	0.29	0.32	0.31	0.58	0.78	0.39	0.29	0.55
	Max	2.72	1.90	0.22	0.38	0.38	0.43	0.64	0.97	0.50	0.36	0.72
Salicopsalus												
S. lucidus												
M (N = 15)	**Mean**	**2.99**	**2.03**	**0.21**	**0.43**	**0.35**	**0.46**	**0.67**	**0.95**	**0.48**	**0.34**	**0.86**
	SD	0.15	0.10	0.03	0.04	0.03	0.04	0.04	0.05	0.04	0.03	0.04
	Range	0.49	0.32	0.10	0.10	0.10	0.16	0.15	0.17	0.16	0.10	0.15
	Min	2.66	1.86	0.17	0.38	0.31	0.37	0.60	0.84	0.38	0.29	0.80
	Max	3.15	2.18	0.26	0.48	0.41	0.53	0.75	1.01	0.54	0.40	0.95

TABLE 1
(Continued)

		Length						Width				
		Body	CunClyp	Head	Pron	Scut	Cun	Head	Pron	Scut	InterOc	AntSeg2
***Salicopsalus** (continued)*												
***S. lucidus** (continued)*												
F (N = 16)	**Mean**	**3.11**	**2.17**	**0.18**	**0.42**	**0.39**	**0.45**	**0.72**	**0.99**	**0.53**	**0.41**	**0.87**
	SD	0.18	0.12	0.03	0.02	0.03	0.05	0.03	0.06	0.04	0.02	0.04
	Range	0.58	0.51	0.13	0.09	0.12	0.18	0.09	0.16	0.11	0.09	0.14
	Min	2.76	1.94	0.17	0.36	0.32	0.38	0.63	0.90	0.44	0.36	0.73
	Max	3.34	2.46	0.30	0.45	0.44	0.56	0.72	1.06	0.56	0.45	0.87
S. schwartzi												
M (N = 2)	**Mean**	**2.63**	**1.75**	**0.15**	**0.33**	**0.32**	**0.44**	**0.60**	**0.89**	**0.44**	**0.27**	**0.68**
	SD	0.06	0.03	0.04	0.02	0.01	0.04	0.01	0.00	0.01	0.01	0.02
	Range	0.08	0.04	0.06	0.03	0.01	0.06	0.02	0.00	0.01	0.02	0.03
	Min	2.59	1.73	0.12	0.31	0.31	0.41	0.59	0.89	0.43	0.27	0.67
	Max	2.67	1.77	0.18	0.34	0.32	0.47	0.61	0.89	0.45	0.28	0.69
F (N = 5)	**Mean**	**2.28**	**1.61**	**0.15**	**0.30**	**0.29**	**0.33**	**0.58**	**0.81**	**0.39**	**0.33**	**0.55**
	SD	0.08	0.05	0.02	0.02	0.03	0.03	0.02	0.03	0.02	0.03	0.03
	Range	0.18	0.13	0.05	0.04	0.08	0.08	0.05	0.06	0.05	0.07	0.07
	Min	2.17	1.52	0.12	0.29	0.25	0.30	0.55	0.78	0.37	0.31	0.52
	Max	2.35	1.65	0.17	0.32	0.33	0.38	0.61	0.84	0.42	0.37	0.59
Stictopsallus												
S. aspersus												
M (N = 16)	**Mean**	**2.60**	**1.81**	**0.17**	**0.35**	**0.37**	**0.39**	**0.66**	**0.88**	**0.47**	**0.32**	**0.70**
	SD	0.16	0.08	0.04	0.02	0.02	0.06	0.03	0.09	0.03	0.03	0.03
	Range	0.56	0.31	0.15	0.06	0.06	0.26	0.10	0.40	0.08	0.09	0.11
	Min	2.28	1.65	0.11	0.32	0.33	0.20	0.61	0.57	0.43	0.27	0.65
	Max	2.84	1.96	0.26	0.38	0.39	0.46	0.71	0.97	0.51	0.36	0.76
F (N = 19)	**Mean**	**2.58**	**1.79**	**0.17**	**0.34**	**0.37**	**0.38**	**0.63**	**0.90**	**0.47**	**0.33**	**0.64**
	SD	0.13	0.08	0.03	0.02	0.02	0.04	0.03	0.05	0.03	0.02	0.05
	Range	0.43	0.36	0.12	0.06	0.09	0.16	0.11	0.20	0.10	0.08	0.20
	Min	2.43	1.61	0.12	0.30	0.34	0.32	0.59	0.83	0.42	0.30	0.51
	Max	2.86	1.97	0.23	0.37	0.43	0.48	0.70	1.02	0.52	0.37	0.71
Schaffneropsallus												
S. oaxacensis												
M (N = 4)	**Mean**	**2.53**	**1.81**	**0.18**	**0.30**	**0.34**	**0.34**	**0.60**	**0.80**	**0.42**	**0.30**	**0.72**
	SD	0.10	0.05	0.02	0.03	0.01	0.02	0.02	0.05	0.02	0.02	0.01
	Range	0.24	0.12	0.04	0.07	0.03	0.05	0.05	0.12	0.05	0.04	0.03
	Min	2.41	1.75	0.16	0.27	0.32	0.31	0.57	0.75	0.39	0.28	0.70
	Max	2.65	1.87	0.20	0.34	0.36	0.36	0.62	0.87	0.44	0.32	0.74
F (N = 3)	**Mean**	**2.57**	**1.81**	**0.18**	**0.32**	**0.33**	**0.34**	**0.55**	**0.78**	**0.41**	**0.28**	**0.70**
	SD	0.05	0.05	0.01	0.01	0.02	0.02	0.03	0.05	0.03	0.04	0.04
	Range	0.09	0.09	0.03	0.01	0.03	0.04	0.05	0.09	0.05	0.07	0.07
	Min	2.54	1.77	0.17	0.31	0.31	0.32	0.53	0.75	0.38	0.25	0.65
	Max	2.63	1.86	0.20	0.32	0.34	0.36	0.58	0.84	0.43	0.32	0.72

to anterior margin of pronotum; frons weakly protruding beyond anterior margin of eyes; posterior margin of vertex rounded; eyes not enlarged in dorsal (fig. 1) and lateral views, occupying about about three-fourths of height of head; antennae inserted just above ventral margin of eyes, eyes very weakly emarginate at antennal insertion; antennal segment 2 weakly tapered proximally, of similar conformation to that of female; labium reaching to apex of hind coxae. Thorax: Mesothoracic spiracle and metathoracic scent-efferent system similar to that of *Bisulcopsallus* spp. as determined

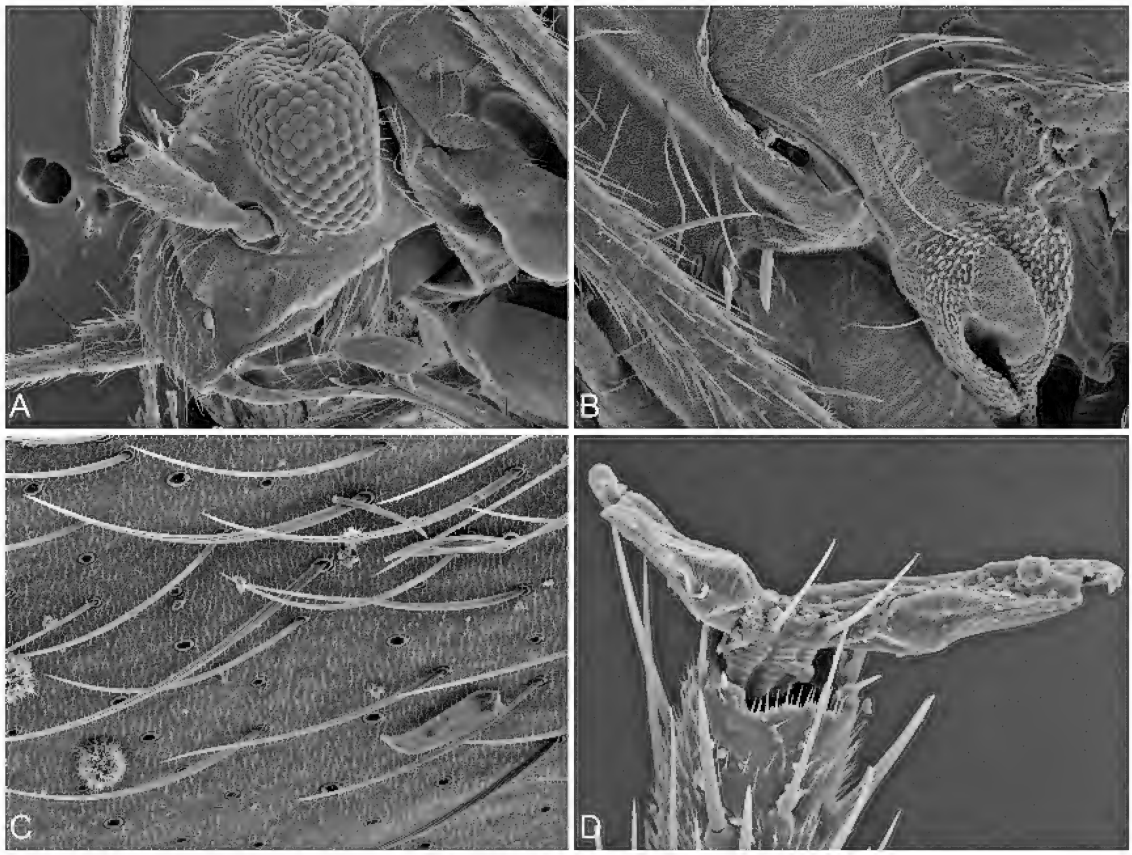


Fig. 4. *Arizonapsallus stonedahli:* **A.** Lateral view of head. **B.** Mesothoracic spiracle and metathoracic scent-efferent system. **C.** Setae on costal margin of wing. **D.** Ventral view of pretarsus.

from light-microscope examination of dried specimens. *Legs:* Claws moderately elongate, smoothly curving, pulvilli small, flaplike, located near middle of claw, parempodia setiform. Abdomen: Broad. GENITALIA (fig. 5): Pygophore: Conical, lacking tubercle on left side. Vesica: Formed of a single strap, apically attenuated, extending beyond secondary gonopore by about 2 times length of gonopore; secondary gonopore small, ovoid, without distinct gonopore sclerite. Phallotheca: Apical portion elongate, tapered, with a slender spine on ventral surface reaching about one-half distance to apex of phallotheca. Parameres: Left paramere of form found in many Phylini, but anterior process distinctly broadened and posterior process distinctly truncate; right paramere distinctly elongate, flattened, broad, and nearly parallel, lying over phallotheca and left paramere in repose.

Female: Elongate ovoid; total length 2.30–2.41, length apex clypeus–cuneal fracture 1.64–1.67, width pronotum 0.73–0.81. COLORATION: As in male. SURFACE AND VESTITURE: As in male. STRUCTURE: Hemelytra just covering abdomen; eyes of similar size to those of male; antennal segment 2 tapered toward base, of similar structure to that in male. GENITALIA (fig. 4): Sclerotized rings more or less quadrangular; vestibulum large, tubular, vaguely nautiloid in shape, asymmetrical, but more or less central in position, entrance and exit apparently from closely apposed positions at base of ovipositor valves, apparent endpoint of vestibulum forming a large "chamber", at which point vestibulum doubles back on itself; insertion of accessory gland apparently removed anteriorly from base of lateral oviducts; posterior wall apparently destroyed in only dissected specimen.

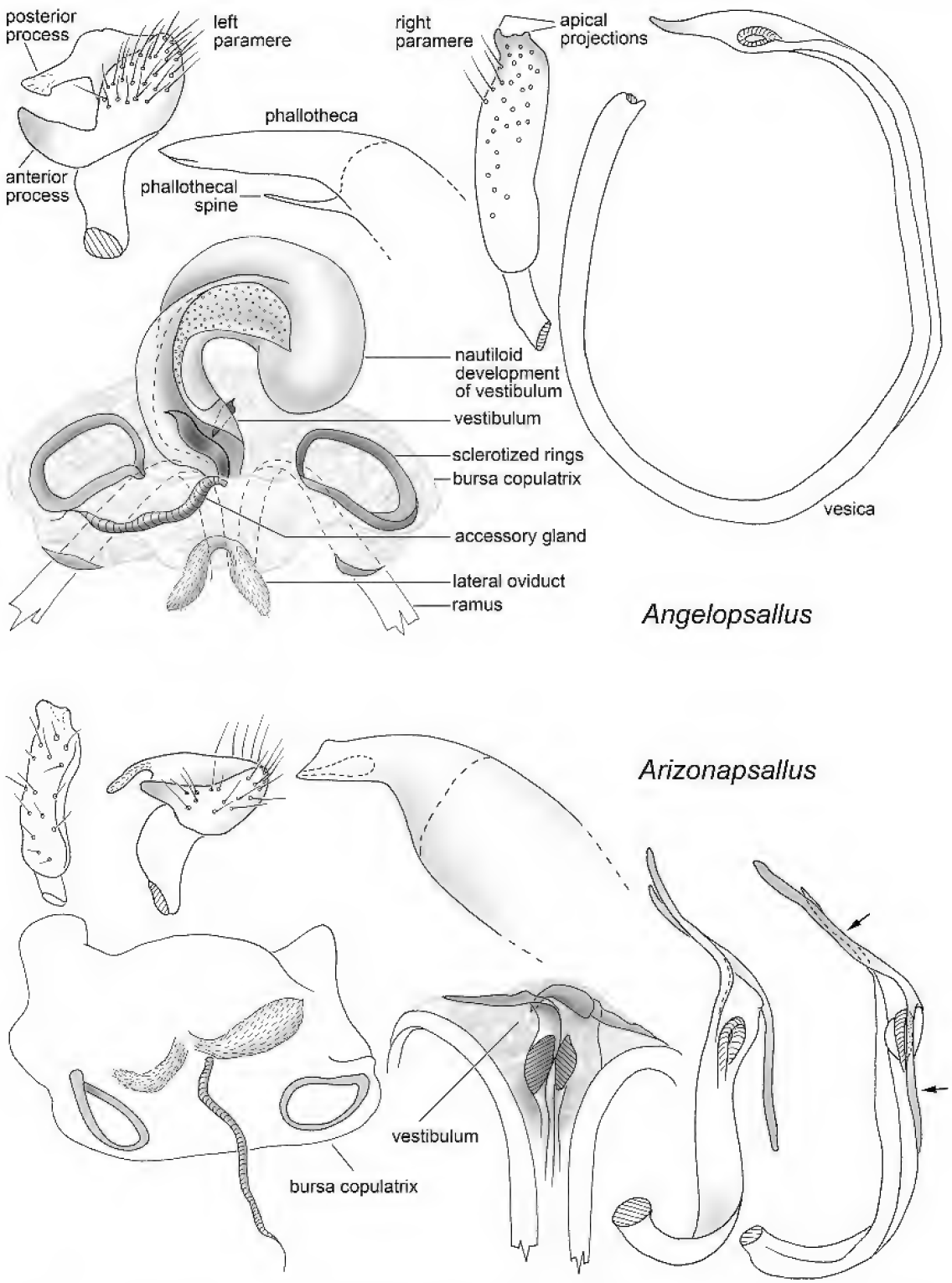
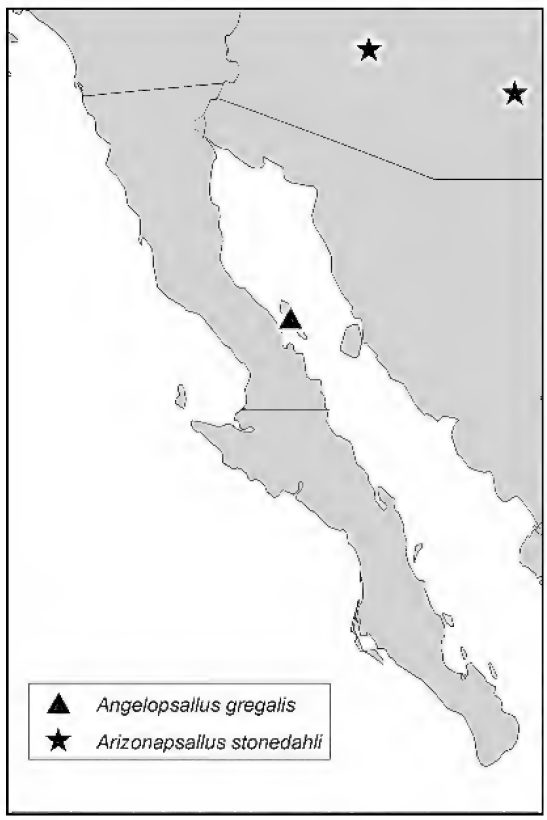


Fig. 5. *Angelopsallus gregalis* (upper) (male genitalia: AMNH_PBI 00077130; female genitalia: AMNH_PBI 00077131). *Arizonapsallus stonedahli* (lower) (male genitalia: AMNH_PBI 00096983, right paramere only, AMNH_PBI 00063971; female genitalia: AMNH_PBI 00063971).



Map 1. Distribution of *Angelopsallus* and *Arizonapsallus* spp.

ETYMOLOGY: Named for the type locality, Angel de la Guardia Island, Gulf of California, Mexico, in combination with the generic name *Psallus*. Gender masculine.

HOST: *Sideroxylon leucophyllum* S. Watson (Sapotaceae) (Van Duzee, 1923).

DISCUSSION: Many specimens from the Van Duzee collection, housed in the California Academy of Sciences, are badly faded. I have relied on the original description of Van Duzee (1923) as a way of understanding the original coloration of the present species.

The vestibulum in the female of *Angelopsallus gregalis* (fig. 5) is greatly enlarged, a condition also seen in *Bisulcopsallus* (fig. 8) and *Ceratopsallus* (fig. 17). This enlargement differs significantly from the type reported by Henry and Schuh (1979) in *Hambletoniola* Carvalho and *Larinocerus* Froeschner (as *Beamerella* Knight), and as known from some other phyline taxa on the basis of unpublished observations (M.D. Schwartz, personal comm.). In *Hambletoniola* and *Larinocerus* the sclerotized tubular vestibulum leads from the base of the ovipositor valves to a position laterally on the bursa copulatrix, whereas in *Angelopsallus*, *Bisulcopsallus*, and *Ceratopsallus* the vestibular tube doubles back on itself, causing the proximal and distal portions of the tube to lie parallel to one another and the entry and exit points of the tube to be very close together.

Angelopsallus gregalis (Van Duzee), new combination
figures 1, 4, 5; map 1

Psallus gregalis Van Duzee, 1923: 159 (n.sp.).

DIAGNOSIS: See generic diagnosis.

DESCRIPTION: See generic description.

HOST: Recorded by Van Duzee (1923) from *Sideroxylon leucophyllum* (Sapotaceae).

DISTRIBUTION (map 1): Known only from Angel de la Guardia Island, Gulf of California, Baja California Norte, Mexico.

HOLOTYPE: **MEXICO: Baja California Norte:** Angel de la Guardia Island, Palm Canyon [29.33333°N 113.41666°W], 03 May 1921, E.P. Van Duzee, 1♂ (AMNH_PBI 00077831) (CAS).

PARATYPES: **MEXICO: Baja California Norte:** Angel de la Guardia Island, Palm Canyon, 29.33333°N 113.41666°W, 03 May 1921, E.P. Van Duzee, 1♂ (AMNH_PBI 00077130), 1♀ (AMNH_PBI 00077131) (AMNH). 5♂ (AMNH_PBI 00068781, AMNH_PBI 00077129, AMNH_PBI 00077208–AMNH_PBI 00077210), 2♀ (AMNH_PBI 00077132, AMNH_PBI 00077133) (CAS).

Arizonapsallus, new genus

Type species: *Arizonapsallus stonedahli*, new species.

DIAGNOSIS: Recognized by the the relatively large size within the *Phymatopsallus* group, total length 3.48–3.71, the pale coloration, spotted dorsum, and the left side of the pygophore lacking a specialized field of spicules or a tubercle. Most similar to *Cercocarpopsallus* in structure of the male genitalia, especially the two terminal spines on the vesica (figs. 5, 25, 26). Similar in size and coloration to several *Bisulcopsallus* (fig. 1) and *Ceratopsallus* spp. (fig. 2), but readily distinguished from members of those

two groups by their possession of a tubercle on left side of the pygophore.

DESCRIPTION: *Male:* Moderately large among *Phymatopsallus*-group taxa, elongate, nearly parallel-sided, total length 3.48–3.71, length apex clypeus–cuneal fracture 2.17–2.33, width pronotum 0.92–1.00. COLORATION (fig. 1): Body and forewings pale, uniformly and densely covered with small brown spots; membrane marmorate; veins of membrane mostly pale; head, pronotum and scutellum with less conspicuous spotting; eyes silvery; coloration of appendages pale greenish, femora with scattered, weak, brown spots; tibial spines dark with dark bases. SURFACE AND VESTITURE (fig. 1): Dorsal body surface smooth, impunctate, weakly shining. Dorsal vestiture of recumbent, silvery setae. STRUCTURE: Head: Weakly transverse, posterior margin of eyes contiguous with anterior margin of pronotum, frons weakly protruding beyond anterior margin of eyes (fig. 1); posterior margin of vertex indistinct; eyes as in female, not showing sexual dimorphism, occupying approximately two-thirds height of head, vertex relatively broad (fig. 1); antennae inserted above ventral margin of eye by roughly diameter of segment 1, insertion contiguous with eye; antennal segment 2 cylindrical, of approximately same diameter as segment 1, similar in conformation to that of female, much longer than width of head (ratio 0.94:0.63); labium reaching to apex of hind trochanters. Thorax: Mesothoracic spiracle and metathoracic scent-efferent system similar in structure to that of *Bisulcopsallus* spp. (see fig. 6B). *Legs:* Claws strongly bent preapically, pulvilli flaplike, moderately large, reaching to near apex of claw, parempodia setiform. Abdomen: Broad basally, tapered posteriorly. GENITALIA (fig. 5): Pygophore: Conical, without specialized setae or tubercle as found in many other *Phymatopsallus*-group taxa. Vesica: Relatively short and stout, apically with two slender spines, one apparently bifid, two spine branches extending in parallel well beyond gonopore, the other in retrorse fashion extending proximad of secondary gonopore and lying along body of vesica; secondary gonopore moderately large, well sclerotized, ovoid, without gonopore sclerite. Phallotheca: Relatively short, with a weak triangular projection on apicodorsal margin, lacking spinelike projections as found in all other *Phymatopsallus*-group taxa. Parameres: Left paramere with anterior and posterior processes simple, lacking unique structural features; right paramere relatively large, elongate, nearly parallel-sided, apex with a distinct, short process on either side.

Female: Ovoid, much shorter than male; total length 2.88–3.01, length apex clypeus–cuneal fracture 1.99–2.07, width pronotum 0.90–0.96. COLORATION (fig. 1): As in male. SURFACE AND VESTITURE: As in male. STRUCTURE: Hemelytra just covering abdomen; eyes usually similar in size to those of male (fig. 1); antennal segment 2 closely resembling that of male. GENITALIA (fig. 5): Sclerotized rings broader medially than laterally; vestibulum with sclerites at base of ovipositor valves relatively small, as in most Phylinae, without tubular nautiloid development as seen in many other members of *Phymatopsallus* group; posterior wall not visible in only dissected specimen.

ETYMOLOGY: Named for the state of Arizona, its known area of occurrence, in combination with the generic name *Psallus*. Gender masculine.

HOST: Recorded only from the genus *Condalia* (Rhamnaceae).

DISCUSSION: The marmorate membrane and the relatively long, apically truncate right paramere—with two lateral projections apically—lying over the phallotheca in repose and the marmorate membrane place *Arizonapsallus* in the *Phymatopsallus* group of genera. This new taxon closely resembles species of *Bisulcopsallus* and *Ceratopsallus* in size, coloration, and spotting of the dorsum. Nonetheless, the phallotheca bears no spines on any surface, resembling only *Cercocarpopsallus* in this regard (figs 25, 26), but the pygophore lacks the field of spicules found in that taxon; the spines on the vesica can possibly be homologized with those found in *Cercocarpopsallus bispinosus* (fig. 25). As shown in figure 42, this combination of features places *Arizonapsallus* in an unresolved trichotomy with the remaining *Phymatopsallus*-group genera, which are them-

selves resolved into two monophyletic groupings.

Arizonapsallus stonedahli, new species
figures 1, 5; map 1

DIAGNOSIS: See generic diagnosis.

DESCRIPTION: See generic description.

ETYMOLOGY: Named for the collector of most known specimens, Gary M. Stonedahl, in recognition of his contributions to this project and to Miridae taxonomy more generally.

HOST: Recorded only from *Condalia spathulata* A. Gray (Rhamnaceae).

DISTRIBUTION (map 1): Known only from Graham and Maricopa Counties in southern Arizona.

HOLOTYPE: **USA: Arizona: *Graham Co.:*** 3 mi W of Rt 666 on Rt 266 [32.58086°N 109.71094°W], 1219 m, 02 Jun 1983, R.T. Schuh, G.M. Stonedahl, *Condalia spathulata* A. Gray (Rhamnaceae), 1♂ (AMNH_PBI 00096981) (AMNH).

PARATYPES: **USA: Arizona: *Graham Co.:*** 3 mi W of Rt 666 on Rt 266, 32.58086°N 109.71094°W, 1219 m, 02 Jun 1983, R.T. Schuh, G.M. Stonedahl, *Condalia spathulata* (Rhamnaceae), 2♂ (AMNH_PBI 00096982, AMNH_PBI 00096983), 7♀ (AMNH_PBI 00096984–AMNH_PBI 00096988, AMNH_PBI 00096991, AMNH_PBI 00096992) (AMNH). 2♀ (AMNH_PBI 00096989, AMNH_PBI 00096990) (USNM). ***Maricopa Co.:*** Sierra Estrella, 33.21421°N 112.23876°W, 731 m, 24 Apr 1983, J.T. and D.A. Polhemus, 1♂ (AMNH_PBI 00063971) (JTP).

Bisulcopsallus, new genus

Type species: *Phymatopsallus huachucae* Knight.

DIAGNOSIS: Recognized by the novel development of the anterior process of the left paramere with a bifid (cloven) apex (figs. 7–12), in combination with the pale coloration, spotted dorsum in most specimens of most species (fig. 1), and the presence of an elongate, sometimes flattened, spine arising from the ventral surface of the phallotheca (figs. 7–12); pygophore in male always very large with a tubercle on the left side (fig. 6E, F). Medium-sized to moderately large within the *Phymatopsallus* group, total length 2.44–3.50. Most similar to *Ceratopsallus* in structure of the male genitalia, especially the spine on the ventral surface of the phallotheca, the strongly elongated right paramere, and the distinct separation of the posterior process of the left paramere from the paramere body. Readily distinguished from *Ceratopsallus* by the cow horn-shaped anterior process of the left paramere and the usually shorter "non-filamentous" vesica in species of that group (figs. 14–23). *Bisulcopsallus*, as well as *Angelopsallus* and most *Ceratopsallus* spp., separated from most other members of the *Phymatopsallus* complex by the weak sexual dimorphism in the antennae and the eyes.

DESCRIPTION: *Male:* Moderately small to moderately large among *Phymatopsallus*-group taxa, elongate ovoid to nearly parallel-sided, total length 2.44–3.50, length apex clypeus–cuneal fracture 1.59–2.30, width pronotum 0.82–1.10. COLORATION (fig. 1): Body and forewings pale or faded green, sometimes weakly orange; corium, clavus, cuneus, and sometimes head, pronotum, and scutellum with heavy spotting of green, orange, or brown; eyes ranging from silvery or pale to nearly black; coloration of appendages pale, greenish, or weakly orange, femora with scattered, weak, brown spots; tibial spines dark with dark bases; membrane marmorate, usually with some conspicuous large dark areas, especially posterior to the cuneus; veins of membrane pale. SURFACE AND VESTITURE (figs. 1, 6C): Dorsal body surface smooth, impunctate, weakly shining. Dorsal vestiture with recumbent, silvery setae. STRUCTURE: Head: Weakly transverse, posterior margin of eyes contiguous with anterior margin of pronotum, frons weakly protruding beyond anterior margin of eyes; posterior margin of vertex lacking distinct margin; eyes not enlarged relative to those in female (fig. 1); antennae inserted above ventral margin of eye by roughly diameter of segment 1, insertion contiguous with eye (fig. 6A), segment 2 weakly tapered and similar to female; labium reaching from posterior margin of middle trochanters to well past posterior margin of hind trochanters. Thorax: Mesothoracic spiracle and metathoracic scent-efferent system as in figure 6B. *Legs:* Claws strongly bent preapically, pulvilli flaplike, parempodia setiform (fig. 6D). Abdomen: Broad. GENITALIA (figs. 6E, F, 7–12): Pygophore: Very large, almost quadrangular, occupying at least half the length of abdomen, on left side

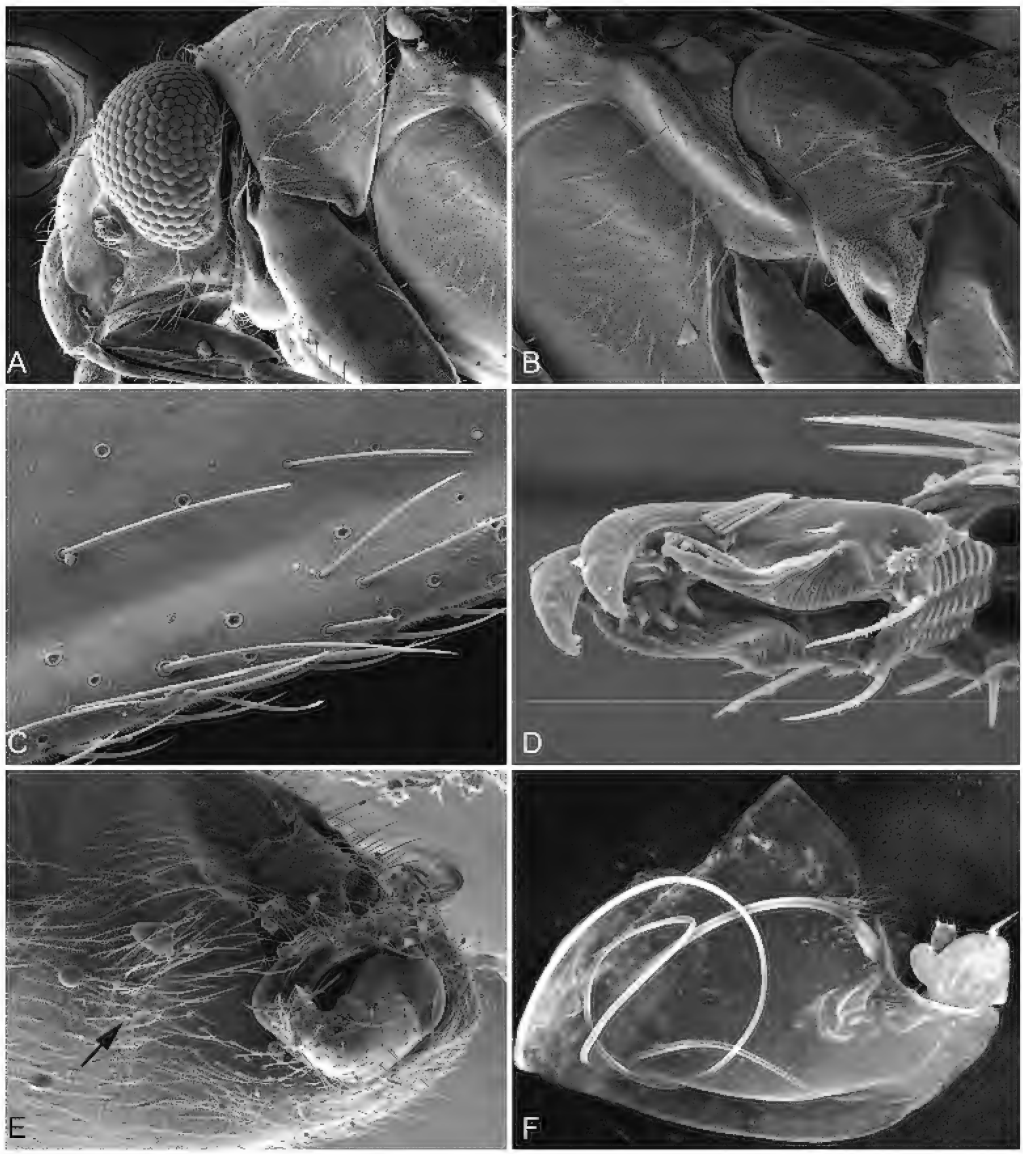
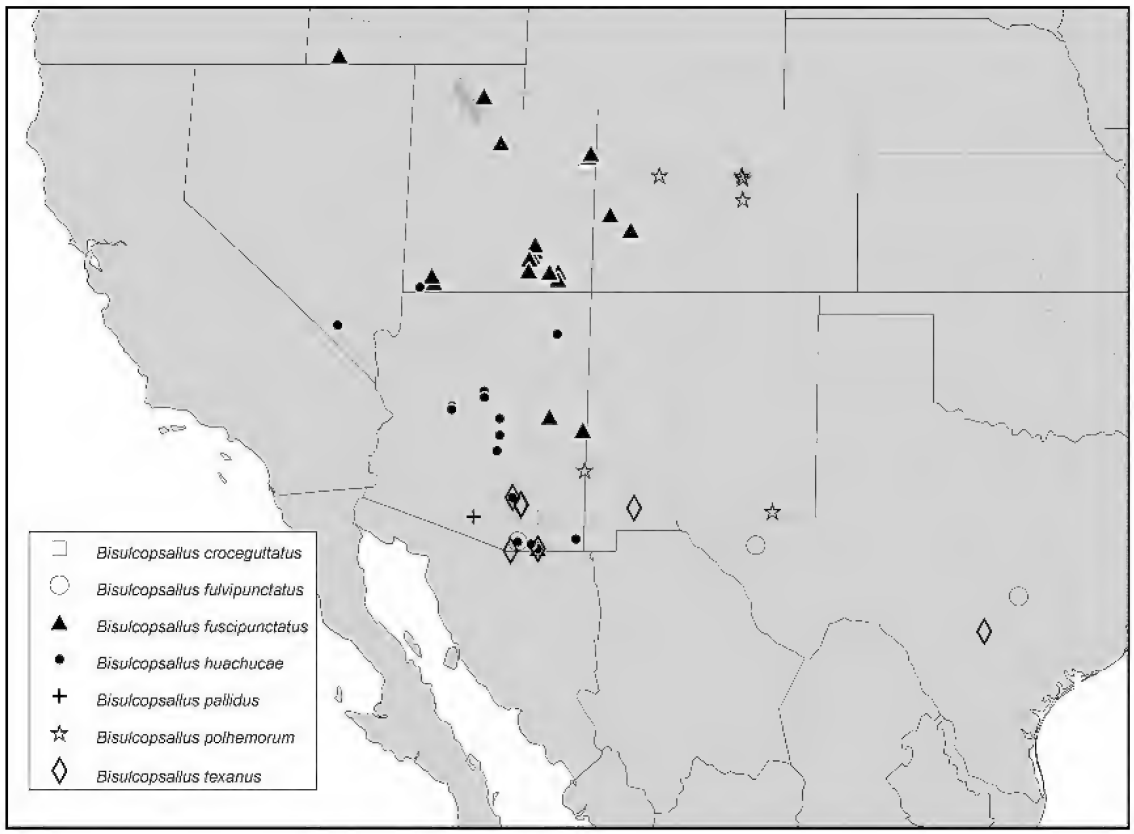


Fig. 6. *Bisulcopsallus fuscipunctatus:* **A.** Lateral view of head. **B.** Mesothoracic spiracle and metathoracic scent-efferent system. **C.** Setae on costal margin of wing. **D.** Lateral view of pretarsus. **E.** Lateral view of pygophore. **F.** *Bisulcopsallus huachucae:* Confocal microscopic image, lateral view, showing in situ position of vesica in pygophore and abdomen.

with a distinct tubercle beset with numerous setae (fig. 6E, F). Vesica: Formed of a single, slender, filamentous strap, varying from long to very long, much of vesica occupying pregenital abdomen in repose (fig. 6F); attenuated apically and extending beyond secondary gonopore by about 2 times length of gonopore; secondary gonopore relatively small, well sclerotized, ovoid, without gonopore sclerite. Phallotheca: Apical portion elongate, relatively slender, tapered, dorsal margin near apex sometimes with a triangular fold, ventral margin always with an elongate, usually slender (sometimes flattened) spine-like process. Parameres: Left paramere with anterior process uniquely with a bifid (cloven) apex, posterior process relatively short, flattened, and straight, always with knoblike



Map 2. Distribution of *Bisulcopsallus* spp.

ornamentation apically; right paramere relatively large, elongate, nearly parallel-sided, curving to the right as viewed from above, apex with a distinct, short, equally developed process on either side.

Female: Elongate ovoid; total length 2.28–3.41, length apex clypeus–cuneal fracture 1.66–2.41, width pronotum 0.86–1.16. COLORATION (fig. 1): As in male. SURFACE AND VESTITURE: As in male. STRUCTURE: Hemelytra extending just beyond apex of abdomen; eyes similar in size to those of male (fig. 1); antennal segment 2 tapered toward base. GENITALIA (figs. 8, 11): Sclerotized rings vaguely triangular; vestibulum tubular, greatly elongated, entrance and exit closely apposed at base of ovipositor valves, turning point of vestibulum forming a "chamber" at which point the channel of vestibulum doubles back on itself; posterior wall either simple or with a transverse sclerotized area in the shape of a yolk near its posterior margin (figs. 8, 11).

ETYMOLOGY: From the Latin *bisulcus*, cloven or forked, and *Psallus*, in reference to the forked nature of the anterior process of the left paramere, in combination with the generic name *Psallus*. Gender masculine.

HOSTS: Recorded from a variety of hosts, with the largest numbers of records being from *Quercus* spp. (Fagaceae), a lesser number from *Fraxinus* spp. (Oleaceae), and all other records represented only by a single host collection event.

DISCUSSION: Although generic placement of *Bisulcopsallus* spp. is unproblematic, especially upon examination of the male genitalia with the filamentous vesica and cloven anterior process of the left paramere, distinguishing the species is not always straightforward. Although the male genitalia provide some useful distinguishing features, even there the species appear to show some variability, which at times confounds making positive identifications.

See also discussion of female genitalia under *Angelopsallus*.

KEY TO MALES OF *BISULCOPSALLUS*

1. Ventral spine on phallotheca slender, tapered to a more or less sharp point (figs. 7, 8, 11) 2
– Ventral spine of phallotheca flattened, broadened at least on apical portion in lateral view (figs. 9, 10, 12) 4
2. Relatively large species, total length usually greater that 3.10; general coloration usually greenish; membrane with large dark areas (fig. 1); posterior process of left paramere not distinctly separated from body of paramere (fig. 8); southern Idaho to eastern Arizona; *Quercus* spp., *Shepherdia* sp. . . . . *fuscipunctatus* Knight
– Smaller species, total length almost always less than 3.10; general coloration usually with some orange; membrane with dark areas less distinct, or absent (fig. 1); posterior process of left paramere distinctly separated from body of paramere (figs. 7, 11) 3
3. Vesica relatively short (fig. 7); central and western Texas, southern Arizona; host unknown . . . . . *fulvipunctatus* Knight
– Vesica very long (fig. 11); Colorado, New Mexico, eastern Arizona. . . . . *Quercus gambelli polhemorum*, new species
4. Relatively large species within *Bisulcopsallus*, total length 3.20 or greater; spines on anterior process of left paramere separated and oriented at 90° to one another; apex of right paramere relatively broad (fig. 10); southern Arizona; host unknown . . . . . *pallidus*, new species
– Smaller species, total length always less than 2.85; spines on anterior process of left paramere lying close to one another and pointing in same general direction (figs. 9, 12); apex of right paramere relatively narrow (figs. 9, 12) 5
5. Apicoventral portion of phallotheca flared (fig. 9); southern Nevada and Utah, Arizona; *Quercus* spp. . . . *huachucae* Knight
– Apicoventral portion of phallotheca not distinctly flared (fig. 12); west-central Texas to southern Arizona; *Fraxinus* spp. . . . . *texanus* Knight

?*Bisulcopsallus croceguttatus* (Knight), tentative new combination
figure 1

Phymatopsallus croceguttatus Knight, 1964: 137 (n.sp).

DISCUSSION: Knight (1964) described this taxon from a single female specimen (USNM) from Texas Pass [Summit], in southeastern Arizona, at an elevation of approximately 5000 feet. At that same locality he also collected a long series of *Phymatopsallus rinconae* Knight (identified by him as *Phymatopsallus strombocarpae* Knight) on *Strombocarpa* (= *Prosopis*) *pubescens*. I am only tentatively assigning the name *croceguttatus* to *Bisulcopsallus*, because positive identifications to genus in the *Phymatopsallus* group are most easily made through the examination of male specimens; ascertaining species identities without recourse to male genitalia could be made through dissection of the female, but only the female holotype is available. Owing to our less than comprehensive survey of the females, I have chosen not to dissect the holotype as a way of further testing the validity of the generic placement of this nominal taxon, because such action would add no new distributional information at the generic level and would not confirm or reject the specific identity of *B. croceguttatus* in the context of our current knowledge of female genitalic structure in the *Phymatopsallus* group. The specimen is large, total length 3.24, length apex clypeus–cuneal fracture, 2.29, width pronotum 1.03; the dorsum is irregularly and rather sparsely covered with relatively large orange spots. It does not fit easily in any of the other described species of *Bisulcopsallus* on the basis of size and coloration, nor does it fit well with known *Ceratopsallus* spp. on the basis of distribution, although the size and type of spotting are reminiscent of *Ceratopsallus croceus* (Van Duzee).

HOLOTYPE: **USA: Arizona: *Cochise Co.:*** Texas Pass (Summit), [32.06314°N 110.07479°W], 1523 m, 20 Jul 1917, H.H. Knight, 1♀ (AMNH_PBI 00069803) (USNM).

Bisulcopsallus fulvipunctatus (Knight), new combination
figures 1, 7; map 2

Phymatopsallus fulvipunctatus Knight, 1964: 137 (n. sp).

DIAGNOSIS: Recognized by the relatively small size among *Bisulcopsallus* spp., average length approximately 2.7, the pale back-

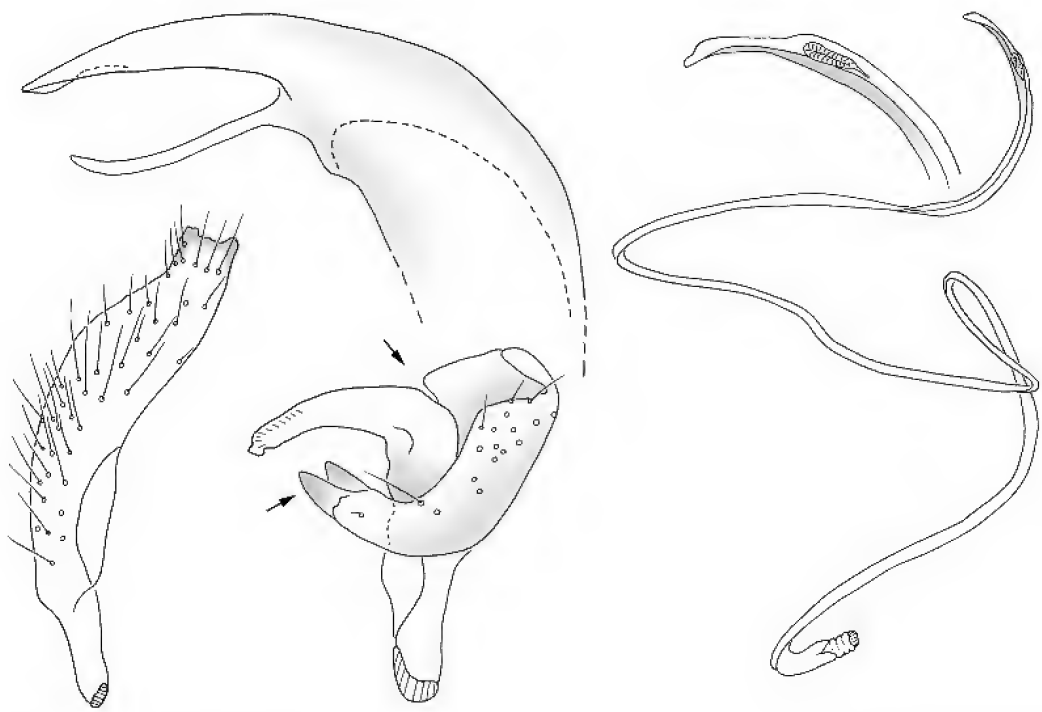


Fig. 7. *Bisulcopsallus fulvipunctatus:* Male genitalia (AMNH_PBI 00068495; entire vesica drawn at 50% scale of other structures; right paramere only: AMNH_PBI 00055983).

ground coloration with dull orange spots primarily on the coriaceous parts of the hemelytra (fig. 1), the relatively short vesica among *Bisulcopsallus* spp., the slender phallothecal spine, the anterior process of the left paramere with relatively heavy spines, the posterior process of the left paramere more or less blunt apically, and the right paramere relatively broad at apex (fig. 7). Most similar in size and coloration to *B. huachucae* (Knight) (fig. 9); separated by its spotting and overall coloration of the body usually being less intensely orange, but with greatest certainty by the structure of the male genitalia, the phallotheca spine in *B. fulvipunctatus* being slender, that in *B. huachucae* being conspicuously flattened over its entire length, the apicoventral portion of the phallotheca being more strongly flared in *B. huachucae*, the posterior process of the left paramere being distinctly separated from the paramere body and the apex being more or less blunt, whereas in *B. huachucae* the posterior process not distinctly separated from paramere body and the apex in the form of a slender projection. Also similar to *B. texanus* (figs. 1, 12) in size, but that species usually more distinctly greenish or nearly devoid of spots and the posterior process of the left paramere not showing a distinct separation from the body of the paramere.

REDESCRIPTION: *Male:* Moderately small among *Bisulcopsallus* spp., elongate ovoid, total length 2.55–2.79, length apex clypeus–cuneal fracture 1.83–1.85, width pronotum 0.91–0.93. COLORATION (fig. 1): Pale, faded orange, with dense covering of orange-brown spots on dorsum; membrane marmorate, without large dark areas, veins pale. SURFACE AND VESTITURE (fig. 1): As in generic description. STRUCTURE: Head: Labium reaching from posterior trochanters onto abdomen. GENITALIA (fig. 7): Vesica: Long, filamentous. Phallotheca: Phallothecal spine slender and weakly curving, reaching to near apex of phallotheca. Parameres: Left paramere with spines on anterior process heavy, closely set,

posterior process distinctly separated from paramere body; right paramere only very weakly narrowed apically.

Female: Elongate ovoid; total length 2.52–2.93, length apex clypeus–cuneal fracture 1.59–1.96, width pronotum 0.88–0.95. COLORATION (fig. 1): As in male. SURFACE AND VESTITURE: As in male. STRUCTURE: Similar to male. GENITALIA: Not examined.

HOST: None recorded.

DISTRIBUTION (map 2): Known from Santa Cruz County, southern Arizona, and Culberson and Travis Counties in western Texas.

DISCUSSION: The identity of this taxon has been fixed based on dissection of a male paratype from Patagonia, Arizona, and comparison with the undissected holotype male (USNM) with the same label data. Further comparisons were made with additional dissected male specimens from Texas. One topotypic paratype male, also dissected, belongs to *B. huachucae*.

HOLOTYPE: **USA: Arizona: *Santa Cruz Co.:*** Patagonia [31.53944°N 110.75556°W], 4000 ft, 12 Jun 1928, A.A. Nichol, 1♂ (AMNH_PBI 00069798) (USNM).

PARATYPES: **USA: Arizona: *Santa Cruz Co.:*** Patagonia, 31.53944°N 110.75556°W, 1219 m, 12 Jun 1928, A.A. Nichol, 1♂ (AMNH_PBI 00068495) (AMNH). 4♂ (AMNH_PBI 00068496, AMNH_PBI 00068615, AMNH_PBI 00068616, AMNH_PBI 00071850), 4♀ (AMNH_PBI 00068497, AMNH_PBI 00068498, AMNH_PBI 00068617, AMNH_PBI 00068618) (USNM).

OTHER SPECIMENS EXAMINED: **USA: Texas: *Culberson Co.:*** Culberson County, 31.45°N, 104.58333°W, 10 Jul 1927, R.H. Beamer, 1♂ (AMNH_PBI 00074850) (KU). ***Travis Co.:*** No specific locality, 30.33333°N, 97.8°W, 13 May 1994, E.G. Riley, 1♂ (AMNH_PBI 00055983) (AMNH). 2♂ (AMNH_PBI 00055982, AMNH_PBI 00056012), 2♀ (AMNH_PBI 00055984, AMNH_PBI 00056013) (TAMU).

Bisulcopsallus fuscipunctatus (Knight), new combination
figures 1, 8; map 2

Phymatopsallus fuscipunctatus Knight, 1964: 135 (n.sp).

DIAGNOSIS: Recognized by the relatively large size among *Bisulcopsallus* spp., average total length approximately 3.2, the weakly greenish background coloration (often yellowish in preserved specimens) with medium-brown spots on the coriaceous portions of the hemelytra, the very long vesica (more than 70 cm in 10× drawing), the slender phallothecal spine, the posterior process of left paramere without a conspicuous break separating it from the paramere body, the elongate body of the left paramere, the apex of the posterior process of the left paramere in the form of a slender protrusion, and the right paramere narrow rather than being conspicuously broad at apex. Most similar is size and coloration to *B. polhemorum*, new species (fig. 1); separated from it most readily by the form of the male genitalia, the vesica in *B. fuscipunctatus* (Knight) being very long (fig. 8), that in *B. polhemorum* much shorter, and the posterior process of the left paramere in *B. fuscipunctatus* not distinctly separated from the paramere body, the apex in the form of a narrow projection (fig. 8), whereas in *B. polhemorum* the posterior process distinctly separated from the paramere body and the apex of the process more or less blunt (fig. 11).

REDESCRIPTION: *Male:* Moderately large among *Bisulcopsallus* spp., elongate ovoid, total length 2.91–3.40, length apex clypeus–cuneal fracture 1.91–2.32, width pronotum 0.94–1.06. COLORATION (fig. 1): Pale, faded greenish, with moderately dense covering of brown spots on clavus, corium, and cuneus; membrane marmorate (sometimes vaguely) with additional large dark areas posterior to cuneus and on posterior margin of cells, veins pale to infuscate. SURFACE AND VESTITURE (figs. 1, 6D): As in generic description. STRUCTURE: Head: Labium reaching to posterior trochanters or slightly beyond. GENITALIA (fig. 8): Vesica: Very long, filamentous. Phallotheca: Phallothecal spine slender, reaching about two-thirds of distance toward apex of phallotheca, apex of phallotheca with a subapical triangular projection on dorsal margin. Parameres: Left paramere with spines on anterior process heavy, noticeably divergent, posterior process not distinctly separated from paramere body; right paramere moderately narrowed apically.

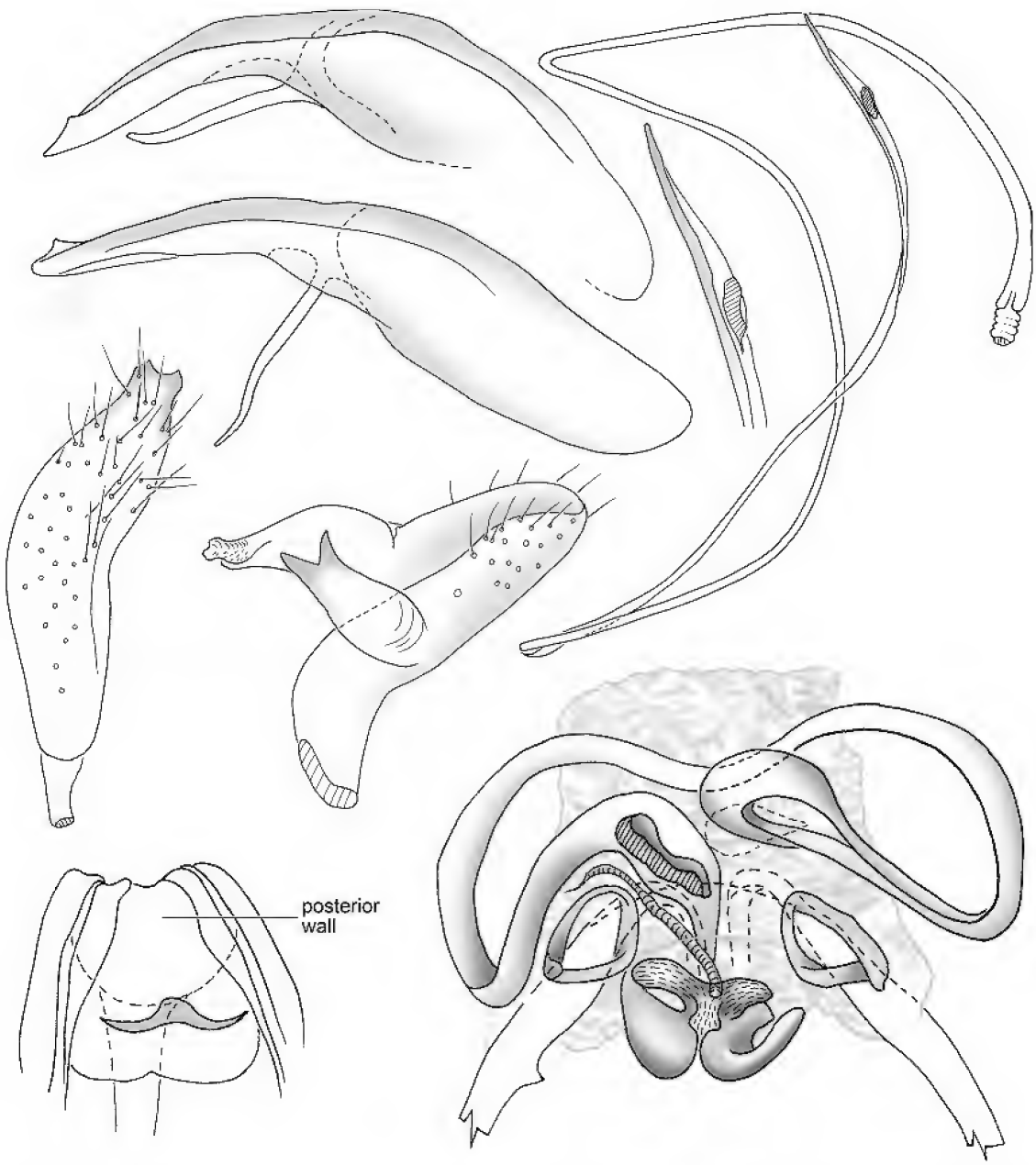


Fig. 8. *Bisulcopsallus fuscipunctatus:* Male genitalia (AMNH_PBI 00062958; entire vesica drawn at 50% scale of other structures; upper phallotheca: AMNH_PBI 00062836); female genitalia (AMNH_PBI 00062921).

Female: Elongate ovoid; total length 2.83–3.22, length apex clypeus–cuneal fracture 1.95–2.22, width pronotum 0.87–1.05. COLORATION (fig. 1): As in male. SURFACE AND VESTITURE: As in male. STRUCTURE: Similar to male. GENITALIA (fig. 8): See generic description.

HOST: Recorded from *Shepherdia rotundifolia* Parry (Eleagnaceae), *Quercus gambellii* Nutt. and *Quercus undulata* Torr. (Faga-

ceae), and *Clematis ligustifolia* Nutt. ex T. & G. (Ranunculaceae). A single specimen recorded from *Artemisia tridentata* Nutt., but this certainly represents a sitting record.

DISTRIBUTION (map 2): Widely distributed from southern Idaho, across Utah, and into western Colorado and eastern Arizona.

DISCUSSION: The identity of this species is based on the dissection of specimens that are within the distributional range of the type locality (Y Mountain, near Provo, Utah) and are also similar in color and morphology to the holotype. This is the only species known from the most northerly parts of the combined range of *Bisulcopsallus* spp., and along with *B. polhemorum* is restricted to higher elevations, with the two species showing overlap in eastern Arizona.

HOLOTYPE: **USA: Utah:** ***Utah Co.:*** Y Mountain [40.25662°N 111.60686°W, 2576 m], 24 Jul 1944, C. Lynn Hayward, 1♂ (AMNH_PBI 00069799) (USNM).

PARATYPES: **USA: Idaho:** ***Owyhee Co.:*** Riddle, 42.18666°N 116.11027°W, 1638 m, 27 Jul 1926, P.W. Haegele, 1♀ (AMNH_PBI 00068488) (USNM). **Utah:** ***Utah Co.:*** Y Mountain, 40.25662°N 111.60686°W, 2576 m, 24 Jul 1944, C. Lynn Hayward, 1♂ (AMNH_PBI 00068610) (USNM).

OTHER SPECIMENS EXAMINED: **USA: Arizona:** ***Apache Co.:*** 8 mi N of Alpine, 33.96413°N 109.1425°W, 16 Aug 1982, J.C. Schaffner, 21♂ (AMNH_PBI 00055914–AMNH_PBI 00055922, AMNH_PBI 00055945–AMNH_PBI 00055949, AMNH_PBI 00055961–AMNH_PBI 00055965, AMNH_PBI 00056009, AMNH_PBI 00058279), 51♀ (AMNH_PBI 00055923–AMNH_PBI 00055944, AMNH_PBI 00055950–AMNH_PBI 00055960, AMNH_PBI 00055966–AMNH_PBI 00055981, AMNH_PBI 00056010–AMNH_PBI 00056011) (TAMU). ***Cochise Co.:*** Huachuca Mountains, 5354 Ash Canyon Road, 0.5 mi W of Hwy 92, 31.38194°N 110.22444°W, 1554 m, 02 Jun 1997, T.J. Henry and A.G. Wheeler, Jr, 1♂ (AMNH_PBI 00068494) (USNM). ***Navajo Co.:*** Show Low, Sitgreaves National Forest, 34.25417°N 110.02917°W, 10 Aug 1967, L.A. Kelton, *Quercus* sp. (Fagaceae), 10♂ (AMNH_PBI 00071820–AMNH_PBI 00071828, AMNH_PBI 00071874), 22♀ (AMNH_PBI 00071829–AMNH_PBI 00071849, AMNH_PBI 00071875) (CNC). **Colorado:** ***Mesa Co.:*** 20 mi E of Gateway, Upsweep Canyon, 38.6825°N 108.60405°W, 2073 m, 15 Aug 1987, J.T. and D.A. Polhemus, 3♂ (AMNH_PBI 00063403–AMNH_PBI 00063404, AMNH_PBI 00063428), 3♀ (AMNH_PBI 00063405–AMNH_PBI 00063406, AMNH_PBI 00063430) (JTP). ***Montrose Co.:*** 13 mi SW of Montrose, 38.34494°N 108.04579°W, 2332 m, 13 Aug 1987, T.J. Henry, *Quercus gambelli* (Fagaceae), 6♂ (AMNH_PBI 00068489–AMNH_PBI 00068493, AMNH_PBI 00068778) (USNM). **Utah:** ***Garfield Co.:*** 14.3 mi S of Rt 95 on Rt 276, 3.4 mi N of Starr Springs Campground turnoff, 37.87632°N 110.56773°W, 1524 m, 19 Jun 1983, R.T. Schuh and M.D. Schwartz, *Quercus undulata* (Fagaceae), 2♂ (AMNH_PBI 00062954, AMNH_PBI 00062955), 2♀ (AMNH_PBI 00062926, AMNH_PBI 00062927) (AM). *Quercus undulata* (Fagaceae), 34♂ (AMNH_PBI 00062853–AMNH_PBI 00062856, AMNH_PBI 00062930–AMNH_PBI 00062953, AMNH_PBI 00062958–AMNH_PBI 00062960, AMNH_PBI 00063208–AMNH_PBI 00063210), 34♀ (AMNH_PBI 00062860–AMNH_PBI 00062862, AMNH_PBI 00062898–AMNH_PBI 00062925, AMNH_PBI 00063211–AMNH_PBI 00063213). *Shepherdia rotundifolia* (Elaeagnaceae), 12♂ (AMNH_PBI 00062870–AMNH_PBI 00062881), 8♀ (AMNH_PBI 00062882–AMNH_PBI 00062889) (AMNH). *Quercus undulata* (Fagaceae), 2♂ (AMNH_PBI 00062956, AMNH_PBI 00062957), 2♀ (AMNH_PBI 00062928, AMNH_PBI 00062929) (USNM). 8.7 mi S of Rt 95 on Rt 276, Maidenwater Spring, 37.76959°N 110.64457°W, 1524 m, 19 Jun 1983, R.T. Schuh and M.D. Schwartz, *Quercus undulata* Torr. (Fagaceae), 5♂ (AMNH_PBI 00062863–AMNH_PBI 00062867), 2♀ (AMNH_PBI 00062868, AMNH_PBI 00062869) (AMNH). Jct Rts 95 & 276, S of Hanksville, T32S R12E, 38.02505°N 110.57098°W, 1494 m, 18 Jun 1983, R.T. Schuh and M.D. Schwartz, 3♀ (AMNH_PBI 00062895–AMNH_PBI 00062897) (AMNH). ***San Juan Co.:*** 19 mi N of Mexican Hat on Rt 261, T41S R18E, 37.42916°N 109.93144°W, 1981 m, 17 Jun 1983, R.T. Schuh and M.D. Schwartz, *Artemisia tridentata* Nutt. (Asteraceae), 1♂ (AMNH_PBI 00062894) (AMNH). 7.7 mi N of Mexican Hat on Rt 261, T41S R18E, 37.26655°N 109.93422°W, 1524 m, 17 Jun 1983, R.T. Schuh and M.D. Schwartz, *Quercus undulata* Torr. (Fagaceae), 11♂ (AMNH_PBI 00062838–AMNH_PBI 00062848), 4♀ (AMNH_PBI 00062849–AMNH_PBI 00062852) (AMNH). Grand Flat near Collins Canyon, 37.42167°N 110.16056°W, 1707 m, 01 Jun 1982, D.A. and J.T. Polhemus, 1♂ (AMNH_PBI 00063389) (JTP). Moki Canyon near Halls Crossing, 37.71277°N 110.71277°W, 1174 m, 02 Apr 1982, D.A. and J.T. Polhemus, *Quercus undulata* (Fagaceae), 11♂ (AMNH_PBI 00063390–AMNH_PBI 00063399, AMNH_PBI 00063427), 1♀ (AMNH_PBI 00063429) (JTP).

Rim of Moki Canyon near Halls Crossing, 37.45694°N 110.71222°W, 1219 m, 28 May 1978, D.A. and J.T. Polhemus, 3♂ (AMNH_PBI 00062857–AMNH_PBI 00062859) (AMNH). ***Uintah Co.:*** 5–10 mi SW of Bonanza, T10S R24E Sec 17 (R2), 39.9456°N 109.2406°W, 1615 m, 05 Jul 1982–08 Jul 1982, M.D. Schwartz, *Clematis ligustifolia* (Ranunculaceae), 10♂ (AMNH_PBI 00062828–AMNH_PBI 00062836, AMNH_PBI 00063207), 2♀ (AMNH_PBI 00062837, AMNH_PBI 00063181) (AMNH). Bonanza, 40.02111°N 109.17667°W, 18 Sep 1976–07 Jul 1982, G.E. Bohart, 1♂ (AMNH_PBI 00075350) (USU). ***Utah Co.:*** Y Mountain, 40.25662°N 111.60686°W, 2576 m, 24 Jul 1944, C. Lynn Hayward, 1♀ (AMNH_PBI 00068611) (USNM). ***Washington Co.:*** 3.5 mi E of La Verkin, 37.20111°N 113.20536°W, 25 Jun 1980, R.T. Schuh, 1♂ (AMNH_PBI 00062893) (AMNH). Pintura, 37.34083°N 113.27333°W, 11 Aug 1929, R.H. Beamer, 2♂ (AMNH_PBI 00074848, AMNH_PBI 00074849) (KU). ***Weber Co.:*** Warren, 41.28333°N 112.12194°W, 1286 m, 04 Sep 1967, G.F. Knowlton and L.E. Fronk, 1♂ (AMNH_PBI 00068487) (USNM).

Bisulcopsallus huachucae (Knight), new combination
figures 1, 9; map 2

Phymatopsallus huachucae Knight, 1964: 135 (n.sp).
Phymatopsallus rubropunctatus Knight, 1964: 136 (n.sp.). NEW SYNONYMY.
Phymatopsallus longirostris Knight, 1964: 136 (n.sp.). NEW SYNONYMY.

DIAGNOSIS: Recognized by the relatively small size among *Bisulcopsallus* spp., average length approximately 2.7, the usually pinkish or yellowish background coloration with reddish orange spots on the entire dorsum, the very long vesica (more than 70 cm in 10× drawing), the flattened and moderately broad phallothecal spine, the phallotheca with a strong apicoventral flare, the anterior process of the left paramere with relatively weak spines, the posterior process of left paramere not conspicuously separated from the paramere body, the posterior process of the left paramere terminating in a more or less slender projection, and the right paramere relatively narrow along body and at apex. Most similar in size and coloration to *B. fulvipunctatus* (Knight) (fig. 1); separated by the spotting and overall coloration of the body usually being more intensely orange in *B. huachucae* than in other *Bisulcopsallus* spp. (fig. 1), but with greatest certainty by the structure of the male genitalia, the phallothecal spine in *B. huachucae* being conspicuously flattened over its entire length, the apex of the phallotheca flared ventrally, and the posterior process of the left paramere not conspicuously separated from the paramere body (fig. 9); in *B. fulvipunctatus* the phallotheca spine more nearly cylindrical, the apex of the phallotheca not flared ventrally, and the posterior process of the left paramere distinctly separated from the paramere body (fig. 7). Also similar to *B. texanus* in size, but that species usually more distinctly greenish or nearly devoid of spots (fig. 1) and the apicoventral portion of the phallotheca not so strongly flared as in *B. huachucae* (compare figs. 9 and 12).

REDESCRIPTION: *Male:* Moderately small among *Bisulcopsallus* spp., elongate ovoid, total length 2.44–2.83, length apex clypeus–cuneal fracture 1.67–1.97, width pronotum 0.82–0.96. COLORATION (fig. 1): Usually with distinctly orange cast, with moderately dense covering of orange-brown spots on dorsum; membrane marmorate with additional dark area posterior to cuneus, veins pale. SURFACE AND VESTITURE (figs. 1, 6D): As in generic description. STRUCTURE: Head: Labium reaching to posterior trochanters or slightly beyond. GENITALIA (fig. 9): Vesica: Very long, filamentous. Phallotheca: Phallothecal spine flattened, reaching to near apex of phallotheca. Parameres: Left paramere with spines on anterior process of unequal length, weakly divergent, posterior process not distinctly separated from paramere body; right paramere moderately narrowed apically.

Female: Elongate ovoid; total length 2.28–2.61, length apex clypeus–cuneal fracture 1.66–1.81, width pronotum 0.86–0.90. COLORATION (fig. 1): As in male. SURFACE AND VESTITURE: As in male. STRUCTURE: Similar to male. GENITALIA (examined; not illustrated): See generic description.

HOST: Recorded from *Quercus emoryi* Torr., *Q. oblongifolia* Torr., and *Q. turbinella* Greene, *Quercus* sp. (Fagaceae) with a single

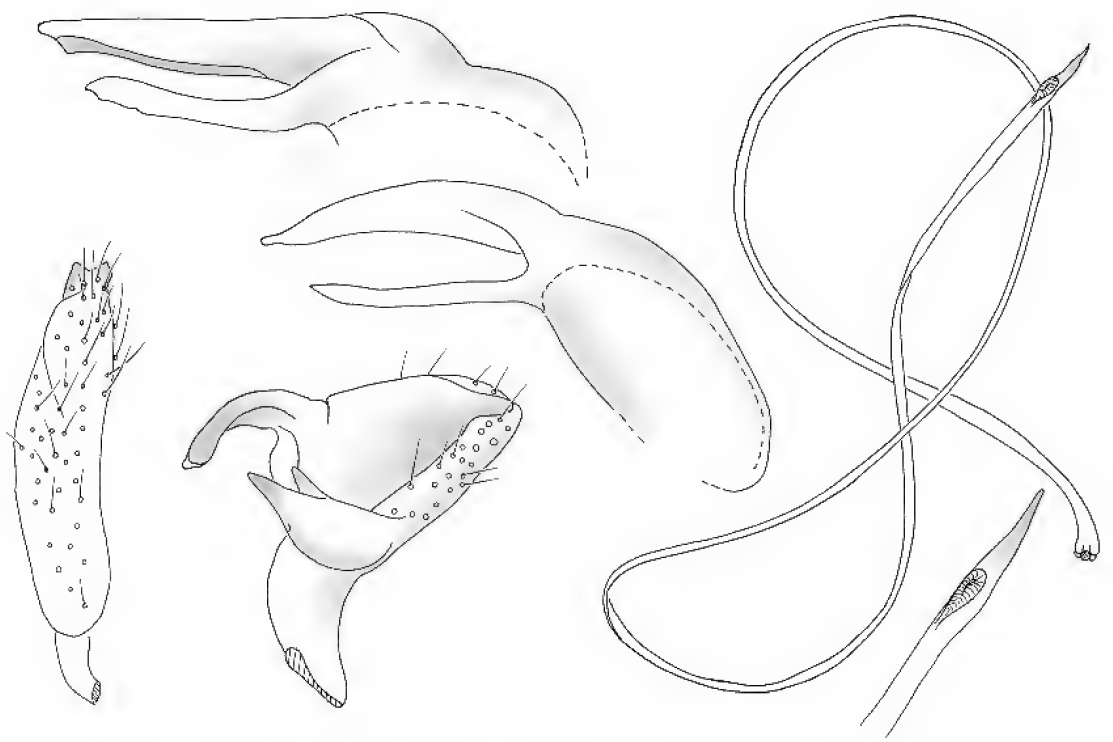


Fig. 9. *Bisulcopsallus huachucae:* Male genitalia (AMNH_PBI 00062967; entire vesica drawn at 50% scale of other structures).

specimen from *Fraxinus velutina* Torr. (Oleaceae).

DISTRIBUTION (map 2): Ranging from southern Nevada and Utah through much of Arizona.

DISCUSSION: Although most specimens of this species are distinctly orange and relatively small among *Bisulcopsallus* spp., some are more greenish and larger, based on comparisons of the male genitalia.

The identity of *B. huachucae* is fixed through dissection of the male genitalia of a topotypic paratype male, and comparison of this specimen with the holotype. Numerous additional specimens from across the range of the species were also dissected.

Knight's (1964) description of *Phymatopsallus rubropunctatus* was based on one male (holotype) and one male and one female specimen from Payson, Arizona, collected by E.D. Ball on August 3, 1929. The relatively small size and reddish coloration suggest that *B. rubropunctatus* represents the same taxon as *B. huachucae*, and the former is here treated as a junior synonym of the latter on the basis of page priority. Knight (1964) compared this nominal taxon only with *B. texanus* (Knight), saying: "Allied to *texanus* in structure of male claspers..., but distinguished by the long rostrum and in having conspicuous reddish dots on the dorsal surface." The parameres in *B. rubropunctatus* are clearly of the type found in any of the six species here placed in *Bisulcopsallus*. The size and coloration of *B. rubropunctatus* are very similar to those of many specimens I have assigned to *B. huachucae*.

Bisulcopsallus longirostris (Knight) was described from 2 male and 2 female specimens from the Chiricahua Mountains of southeastern Arizona. Knight (1964) compared *B. longirostris* to *B. huachucae*, noting that the rostrum in *B. longirostris* was longer, reaching to the middle of the posterior trochanters. The specimen that Knight designated as the holotype is teneral, with the

rostrum being somewhat compressed under the head, indicating that it would actually reach well onto the abdomen, a condition seen in many of the specimens I have assigned to *B. huachucae*. The specimen is pale with weakly marked spots. *Bisulcopsallus longirostris* also fits well within the size range of larger specimens of *B. huachucae*. For these reasons, I am treating *B. longirostris* as a junior synonym of *B. huachucae*, on the basis of page priority.

HOLOTYPES: **USA: Arizona: *Cochise Co.:*** Huachuca Mountains [31.502°N 110.3994°W], 1839 m, 14 Jun 1928, A.A. Nichol, 1♂ (AMNH_PBI 00069794) (USNM) [*B. huachucae*]. Chiricahua Mountains [31.59222°N 109.24°W, 1885 m], 20 Jun 1928, A.A. Nichol, 1♂ (AMNH_PBI 00069796) (USNM) [*B. longirostris*]. ***Gila Co.:*** Payson [34.23083°N 111.325°W, 1500 m], 03 Aug 1929, E.D. Ball, 1♂ (AMNH_PBI 00069795) (USNM) [*B. rubropunctatus*].

PARATYPES: **USA: Arizona: *Cochise Co.:*** Chiricahua Mountains, 31.59222°N 109.24°W, 20 Jun 1928, A.A. Nichol, 2♀ (AMNH_PBI 00069415, AMNH_PBI 00069416) (USNM) [*B. longirostris*]. Huachuca Mountains, 31.502°N 110.3994°W, 1839 m, 14 Jun 1928, A.A. Nichol, 1♂ (AMNH_PBI 00068499), 1♀ (AMNH_PBI 00069414) (USNM) [*B. huachucae*]. ***Gila Co.:*** Payson, 34.23083°N 111.325°W, 1500 m, 03 Aug 1929, E.D. Ball, 1♀ (AMNH_PBI 00069419) (USNM) [*B. rubropunctatus*]. ***Santa Cruz Co.:*** Patagonia, 31.53944°N 110.75556°W, 12 Jun 1928, A.A. Nichol, 1♂ (AMNH_PBI 00068612) (USNM) [*B. fulvipunctatus*].

OTHER SPECIMENS EXAMINED: **USA: Arizona: *Cochise Co.:*** Ash Canyon Road, 0.5 mi W of Hwy 92, 31.38194°N 110.22444°W, 1554 m, 04 Jun 1997, T.J. Henry and A.G. Wheeler, Jr., *Quercus oblongifolia* (Fagaceae), 1♂ (AMNH_PBI 00068559) (USNM); 02 Jun 1997, T.J. Henry and A.G. Wheeler, Jr., *Quercus oblongifolia* (Fagaceae), 1♂ (AMNH_PBI 00068567) *Quercus emoryi* (Fagaceae), 5♂ (AMNH_PBI 00068568–AMNH_PBI 00068572), 7♂ (AMNH_PBI 00068560–AMNH_PBI 00068566) (USNM); 11 Jun 1992–20 Jul 1993, N. McFarland, 31♂ (AMNH_PBI 00068524–AMNH_PBI 00068554) (USNM). Huachuca Mountains, 5354 Ash Canyon Road, 0.5 mi W of Hwy 92, 31.38194°N 110.22444°W, 1554 m, 02 Jun 1997, T.J. Henry and A.G. Wheeler, Jr., *Quercus oblongifolia* (Fagaceae), 1♂ (AMNH_PBI 00068780) (USNM). Huachuca Mountains, Miller Canyon, 31.48889°N 110.4075°W, 14 Jul 1993, N. McFarland, 1♂ (AMNH_PBI 00068558) (USNM). ***Coconino Co.:*** 3.5 mi S of Sedona on Rt 179, T17N R6E S30, 34.8255°N 111.769°W, 1280 m, 15 Jun 1983, R.T. Schuh and M.D. Schwartz, *Quercus* sp. (Fagaceae), 1♂ (AMNH_PBI 00063221), 1♀ (AMNH_PBI 00063224) *Quercus turbinella* Greene (Fagaceae), 22♂ (AMNH_PBI 00063030–AMNH_PBI 00063051), 7♀ (AMNH_PBI 00063052–AMNH_PBI 00063058) (AMNH). ***Gila Co.:*** 14 mi N of Roosevelt Dam on Rt 188, 33.86248°N 111.30844°W, 671 m, 27 May 1983, R.T. Schuh, G.M. Stonedahl, B.M. Massie, 5♂ (AMNH_PBI 00062963–AMNH_PBI 00062967), 8♀ (AMNH_PBI 00062968–AMNH_PBI 00062975) (AMNH). Payson, 34.23083°N 111.325°W, 1500 m, 03 Aug 1929, E.D. Ball, 2♀ (AMNH_PBI 00069417, AMNH_PBI 00069418) (USNM). ***Maricopa Co.:*** 1.3 mi E of Tortilla Flat, 33.52639°N 111.36654°W, 10 May 1980, J.D. Pinto, *Quercus* sp. (Fagaceae), 1♂ (AMNH_PBI 00082281) (UCR). ***Pima Co.:*** Santa Catalina Mountains, Molino Basin, 32.5°N 110.92056°W, 01 Jun 1997, T.J. Henry and A.G. Wheeler, Jr., 3♂ (AMNH_PBI 00068555–AMNH_PBI 00068557) *Fraxinus velutina* (Oleaceae), 1♂ (AMNH_PBI 00068779) (USNM). ***Yavapai Co.:*** 1 mi N of I-17 on Rt 179, T15N R6E Sec 18, 34.69423°N 111.75238°W, 1158 m, 15 Jun 1983, R.T. Schuh and M.D. Schwartz, *Quercus turbinella* Greene (Fagaceae), 1♂ (AMNH_PBI 00062986), 1♀ (AMNH_PBI 00063007) (AM). *Quercus turbinella* Greene (Fagaceae), 13♂ (AMNH_PBI 00062976–AMNH_PBI 00062985, AMNH_PBI 00062989, AMNH_PBI 00063220, AMNH_PBI 00063222), 18♀ (AMNH_PBI 00062990–AMNH_PBI 00063006, AMNH_PBI 00063226) (AMNH). *Quercus turbinella* Greene (Fagaceae), 2♂ (AMNH_PBI 00062987, AMNH_PBI 00062988), 2♀ (AMNH_PBI 00063008, AMNH_PBI 00063009) (CNC). 5 mi N of Wilhoit N of Kirkland, 34.49811°N 112.58611°W, 1400 m, 19 Jun 1980, R.T. Schuh, *Quercus turbinella* Greene (Fagaceae), det. B. Ertter, 1980 NYBG, 14♂ (AMNH_PBI 00063011–AMNH_PBI 00063022, AMNH_PBI 00063028–AMNH_PBI 00063029), 5♀ (AMNH_PBI 00063023–AMNH_PBI 00063027) *Quercus turbinella* Greene (Fagaceae), det. B. Ertter, 1980, 1♀ (AMNH_PBI 00063225) (AMNH). Cottonwood, 36.07306°N 109.89167°W, 13 Aug 1975, J.C. Schaffner, 1♂ (AMNH_PBI 00056064) (TAMU). Wilhoit, 34.42583°N 112.58666°W, 1535 m, 25 Jun 1980, J.D. Pinto, *Quercus* sp. (Fagaceae), 1♂ (AMNH_PBI 00082907) (UCR). **Nevada: *Clark Co.:*** Charleston Peak, 36.27222°N 115.69417°W, 2286 m, 22 Jul 1982, J.T. Polhemus, 3♂ (AMNH_PBI 00063431, AMNH_PBI 00063480–AMNH_PBI 00063481) (JTP). **Utah: *Washington Co.:***

Saint George, 37.10417°N 113.58333°W, 853 m, 30 Jun 1965, H.H. Knight, *Quercus* sp. (Fagaceae), 11♂ (AMNH_PBI 00068500–AMNH_PBI 00068510), 13♀ (AMNH_PBI 00068511–AMNH_PBI 00068523), 1♂ (AMNH_PBI 00068613), 1♀ (AMNH_PBI 00068614) (USNM).

Bisulcopsallus pallidus, new species
figures 1, 10; map 2

DIAGNOSIS: Recognized by the relatively large size among *Bisulcopsallus* spp., total length averaging 3.3, the entirely pale coloration, and the structure of the male genitalia, the left paramere with dorsal spine of the anterior process erect and conspicuously removed from the ventral spine, the posterior process lacking a distinct separation from the body of the paramere, and the phallotheca with a broad flare on the apicoventral surface (fig. 10) (the extent of this development approached only in *B. huachucae*). Most similar in its pale coloration and broadened phallothecal process to some specimens of *B. texanus* (fig. 1), but distinguished from that species (and all other *Bisulcopsallus* spp.) by the distinctive structure of the spines on the anterior process of the left paramere and the much broader apicoventral flare on the phallotheca (fig. 10).

DESCRIPTION: *Male:* Moderately large among *Bisulcopsallus* spp., elongate ovoid, total length 3.19–3.50, length apex clypeus–cuneal fracture 2.10–2.38, relatively broad bodied, width pronotum 1.07–1.10. COLORATION (fig. 1): Pale; membrane at most weakly marmorate, with limited dark area posterior to cuneus, veins pale. SURFACE AND VESTITURE (figs. 1, 6D): As in generic description. STRUCTURE: Head: Labium reaching to about posterior trochanters (condition not clear in nearly all available specimens). GENITALIA (fig. 10): Vesica: Long, filamentous. Phallotheca: Phallothecal spine flattened, reaching to near apex of phallotheca, with serrate apicoventral margin. Parameres: Left paramere with spines on anterior process separated, of unequal length, strongly divergent, dorsal spine at right angles to ventral, posterior process not distinctly separated from paramere body; right paramere sinuously curving and of nearly uniform width.

Female: Elongate ovoid; total length 3.23–3.41, length apex clypeus–cuneal fracture 2.17–2.41, width pronotum 1.10–1.16. COLORATION (fig. 1): As in male. SURFACE AND VESTITURE: As in male. STRUCTURE: Similar to male. GENITALIA: Not examined.

HOST: No known host records.

DISTRIBUTION (map 2): Known only from the Rincon Mountains, Pima County, south-central Arizona.

HOLOTYPE: **USA: Arizona: *Pima Co.:*** Rincon Mountains [32.07611°N 111.91722°W], alt. [ft.], 27 May 1928, A.A. Nichol, 1♂ (AMNH_PBI 00068622) (USNM).

PARATYPES: **USA: Arizona: *Pima Co.:*** Rincon Mountains, 32.07611°N 111.91722°W, alt. 3300, 27 May 1928, A.A. Nichol, 1♂ (AMNH_PBI 00068620–AMNH_PBI 00068621), 4♀ (AMNH_PBI 00068623–AMNH_PBI 00068626) (USNM); 1♂ (AMNH_PBI 00068619) (AMNH).

Bisulcopsallus polhemorum, new species
figures 1, 11; map 2

DIAGNOSIS: Recognized by the relatively large size among *Bisulcopsallus* spp., average length approximately 3.0, the weakly greenish background coloration (often yellowish in preserved specimens) with medium-brown spots on the coriaceous portions of the hemelytra, the relatively short vesica, the relatively slender phallothecal spine, the posterior process of the left paramere distinctly separated from the paramere body, the relatively short body of the left paramere, the apex of the posterior process of the left paramere more or less blunt, and the right paramere narrowed and not conspicuously broad at apex (fig. 11). Most similar is size and coloration to *B. fuscipunctatus* (Knight); separated from it most readily by the form of the male genitalia, the vesica in *B. polhemorum* being relatively short, that in *B. fuscipunctatus* being much shorter (fig. 8), and the posterior process of the left paramere in *B. polhemorum* distinctly separated from the paramere body, the apex more or less blunt, whereas in *B. fuscipunctatus* the posterior process not distinctly separated from the paramere body and the apex of

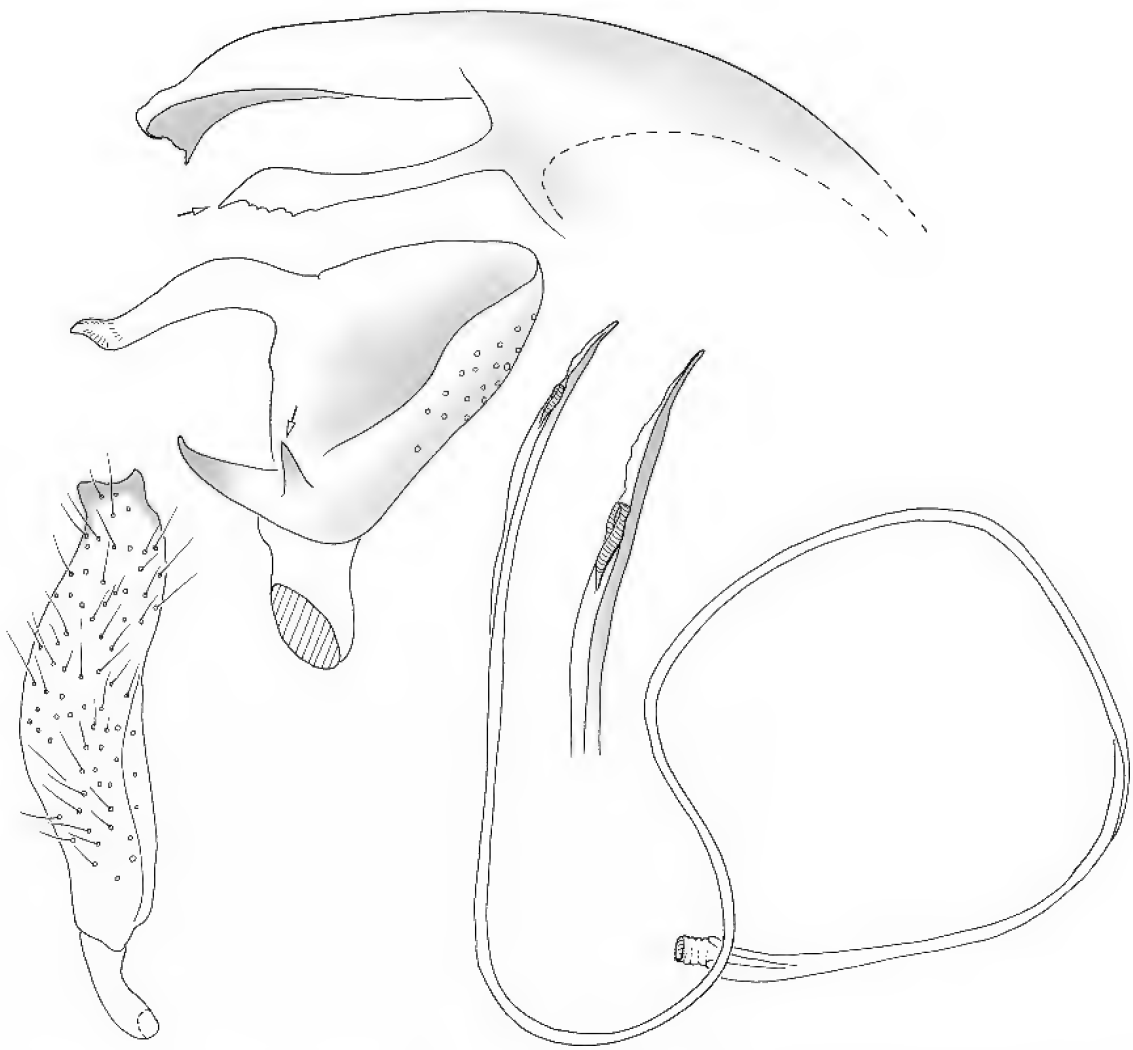


Fig. 10. *Bisulcopsallus pallidus:* Male genitalia (AMNH_PBI 00068621; entire vesica drawn at 50% scale of other structures).

the process in the form of a slender projection (fig. 8).

DESCRIPTION: *Male:* Size moderate among *Bisulcopsallus* spp., elongate ovoid, total length 2.70–3.21, length apex clypeus–cuneal fracture 1.91–2.14, width pronotum 0.91–1.04. COLORATION (fig. 1): Pale to weakly greenish, with moderately dense covering of greenish-brown spots on clavus, corium, and cuneus; membrane marmorate with additional dark area posterior to cuneus, veins pale. SURFACE AND VESTITURE (figs. 1, 6D): As in generic description. STRUCTURE: Head: Labium reaching to posterior trochanters. GENITALIA (fig. 11): Vesica: Very long, filamentous. Phallotheca: Phallothecal spine slender, curving, reaching about three-fourths of distance toward apex of phallotheca. Parameres: Left paramere with spines on anterior process of unequal length, weakly divergent, posterior process distinctly separated from paramere body; right paramere moderately narrowed apically.

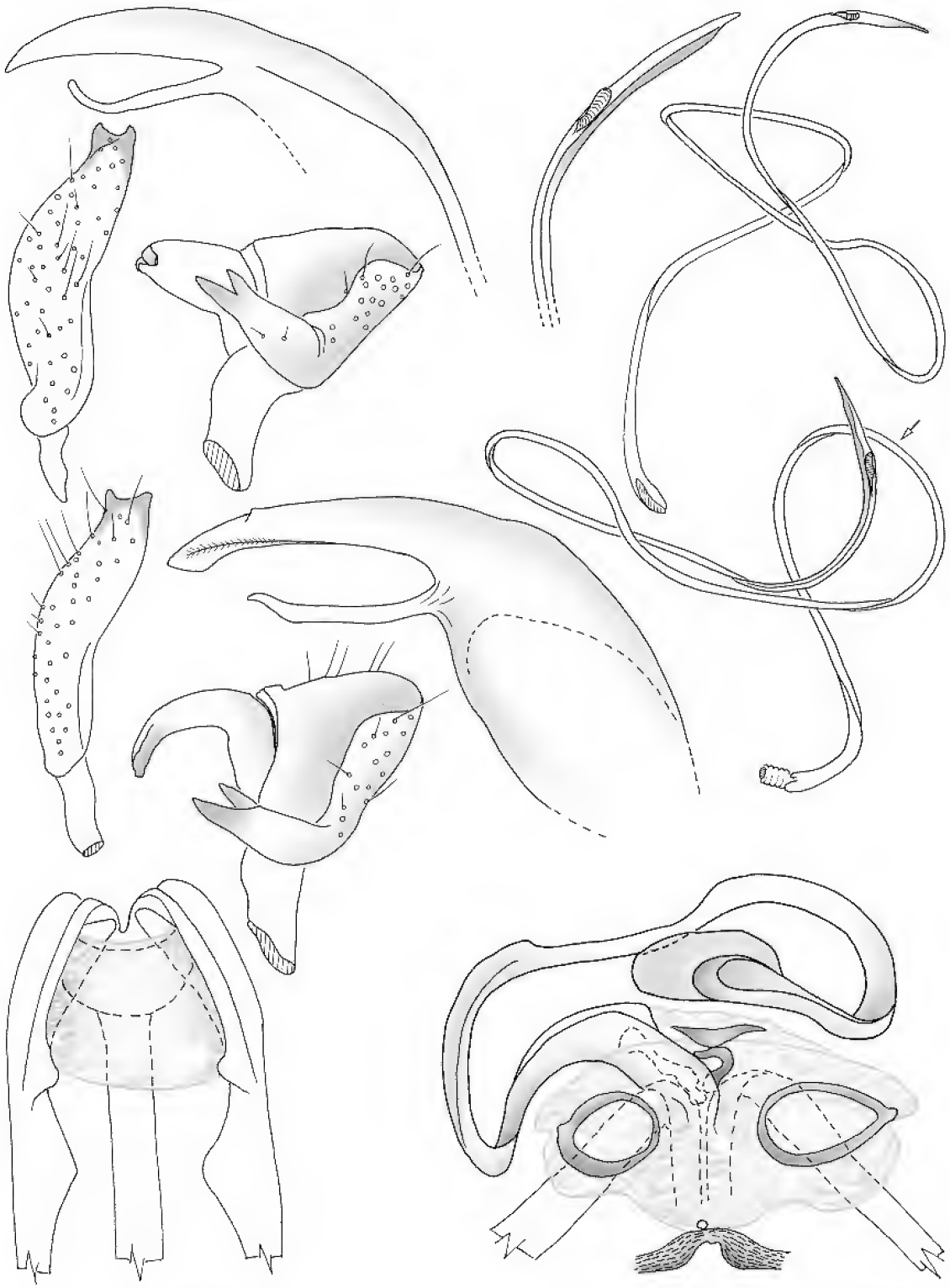


Fig. 11. *Bisulcopsallus polhemorum:* Male genitalia (upper, AMNH_PBI 00055996; lower, 00063432; entire vesica drawn at 50% scale of other structures); female genitalia (AMNH_PBI 00074879, 00063959).

Female: Elongate ovoid; total length 2.77–3.04, length apex clypeus–cuneal fracture 1.90–2.01, width pronotum 0.94–1.02. COLORATION (fig. 1): As in male. SURFACE AND VESTITURE: As in male. STRUCTURE: Similar to male. GENITALIA (fig. 11): See generic description.

ETYMOLOGY: Named for John T. and Dan A. Polhemus, who collected and documented the hosts for much of the known material of this species.

HOST: Known only from *Quercus gambellii* Nutt. (Fagaceae).

DISTRIBUTION (map 2): Known from Colorado, New Mexico, and eastern Arizona.

HOLOTYPE: **USA: Colorado: *Douglas Co.:*** Waterton [39.49361°N 105.08806°W], 06 Aug 1982, D.A. Polhemus, *Quercus gambelli* (Fagaceae), 1♂ (AMNH_PBI 00063434) (JTP).

PARATYPES: **USA: Arizona: *Greenlee Co.:*** Blackjack Campground, 33.1°N 109.06666°W, 20 Jul 2001, J.C. Schaffner, 1♀ (AMNH_PBI 00056016) (AMNH). 3♂ (AMNH_PBI 00055985–AMNH_PBI 00055987), 2♀ (AMNH_PBI 00055988, AMNH_PBI 00055989) (TAMU). **Colorado: *Douglas Co.:*** Waterton, 39.49361°N 105.08806°W, 06 Aug 1982, D.A. Polhemus, *Quercus gambelli* (Fagaceae), 2♀ (AMNH_PBI 00063435, AMNH_PBI 00063437) (AMNH). *Quercus gambelli* (Fagaceae), 2♂ (AMNH_PBI 00063407, AMNH_PBI 00063408), 3♀ (AMNH_PBI 00063418, AMNH_PBI 00063421, AMNH_PBI 00063422) (JTP); 05 Aug 1982, D.A. Polhemus, *Quercus gambelli* (Fagaceae), 1♂ (AMNH_PBI 00063432), 1♀ (AMNH_PBI 00063436) (AMNH). 3♂ (AMNH_PBI 00063409, AMNH_PBI 00063411, AMNH_PBI 00063412), 6♀ (AMNH_PBI 00063419, AMNH_PBI 00063420, AMNH_PBI 00064916–AMNH_PBI 00064919) (JTP); 04 Aug 1982, D.A. Polhemus, *Quercus gambelli* (Fagaceae), 1♂ (AMNH_PBI 00063410) (JTP); 08 Aug 1982, D.A. Polhemus, *Quercus gambelli* (Fagaceae), 1♂ (AMNH_PBI 00063413) (JTP); 17 Aug 1982, D.A. Polhemus, *Quercus gambelli* (Fagaceae), 1♂ (AMNH_PBI 00063433) (AMNH); 03 Aug 1982, D.A. Polhemus, *Quercus gambelli* (Fagaceae), 6♀ (AMNH_PBI 00064910–AMNH_PBI 00064915) (JTP). Waterton, Head of Hiline, 39.49361°N 105.08806°W, 20 Jul 1979, J.T. Polhemus, 1♂ (AMNH_PBI 00063414) (JTP). ***Garfield Co.:*** Glenwood Springs, 39.55056°N 107.32417°W, 1768 m, 17 Aug 1929, P.W. Oman, 1♂ (AMNH_PBI 00074880) (AMNH). 9♂ (AMNH_PBI 00074851–AMNH_PBI 00074859), 6♀ (AMNH_PBI 00074957–AMNH_PBI 00074962) (KU). ***Jefferson Co.:*** Deer Creek Canyon, 39.55265°N 105.12084°W, 1981 m, 12 Aug 1984, J.T. Polhemus, *Quercus gambelli* (Fagaceae), 3♂ (AMNH_PBI 00063415–AMNH_PBI 00063417), 3♀ (AMNH_PBI 00064920–AMNH_PBI 00064922) (JTP); 18 Sep 1984, J.T. Polhemus, *Quercus gambelli* (Fagaceae), 1♀ (AMNH_PBI 00064923) (JTP). ***Teller Co.:*** Manitou Park Grange, 39.03°N 105.07833°W, 2018 m, 19 Jul 1900, E.P. Van Duzee, 1♂ (AMNH_PBI 00077832) (CAS). **New Mexico: *Eddy Co.:*** 4.5 mi E of Queen, Hwy 137, Lincoln Natl. Forest, 32.20027°N 104.16666°W, 1675 m, 15 Aug 2001–25 Aug 2001, J.C. Schaffner, 1♂ (AMNH_PBI 00056014), 1♀ (AMNH_PBI 00056015) (AMNH). 7♂ (AMNH_PBI 00055990–AMNH_PBI 00055996), 12♀ (AMNH_PBI 00055997–AMNH_PBI 00056008) (TAMU).

Bisulcopsallus texanus (Knight), new combination
figures 1, 12; map 2

Phymatopsallus texanus Knight, 1964: 134 (n.sp.).

DIAGNOSIS: Recognized by the relatively small size among *Bisulcopsallus* spp., average length approximately 2.6, the pale background coloration with dull weakly brown spots on the coriaceous parts of the hemelytra and in some specimens restricted almost entirely to the cuneus (fig. 1), the relatively long vesica, the flattened, lanceolate phallothecal spine, the posterior process of the left paramere not conspicuously separated from the paramere body, the posterior process with a knoblike projection, and the right paramere relatively narrow at the apex (fig. 12). Most similar in size and coloration to *B. fulvipunctatus* and *B. huachucae*; separated by the spotting and overall coloration of the body being greenish or pale rather than pink or orange as in those species (fig. 1), but with greatest certainty by the structure of the male genitalia, the phallothecal spine in *B. texanus* being flattened over its entire length and pointed apically (fig. 12), unlike *B. fulvipunctatus*, in which the apicoventral portion of the phallotheca much less strongly flared, and the posterior process of the left paramere not distinctly separated from the paramere body (fig. 7) as in *B. huachucae*.

REDESCRIPTION: *Male:* Size moderate among *Bisulcopsallus* spp., elongate ovoid,

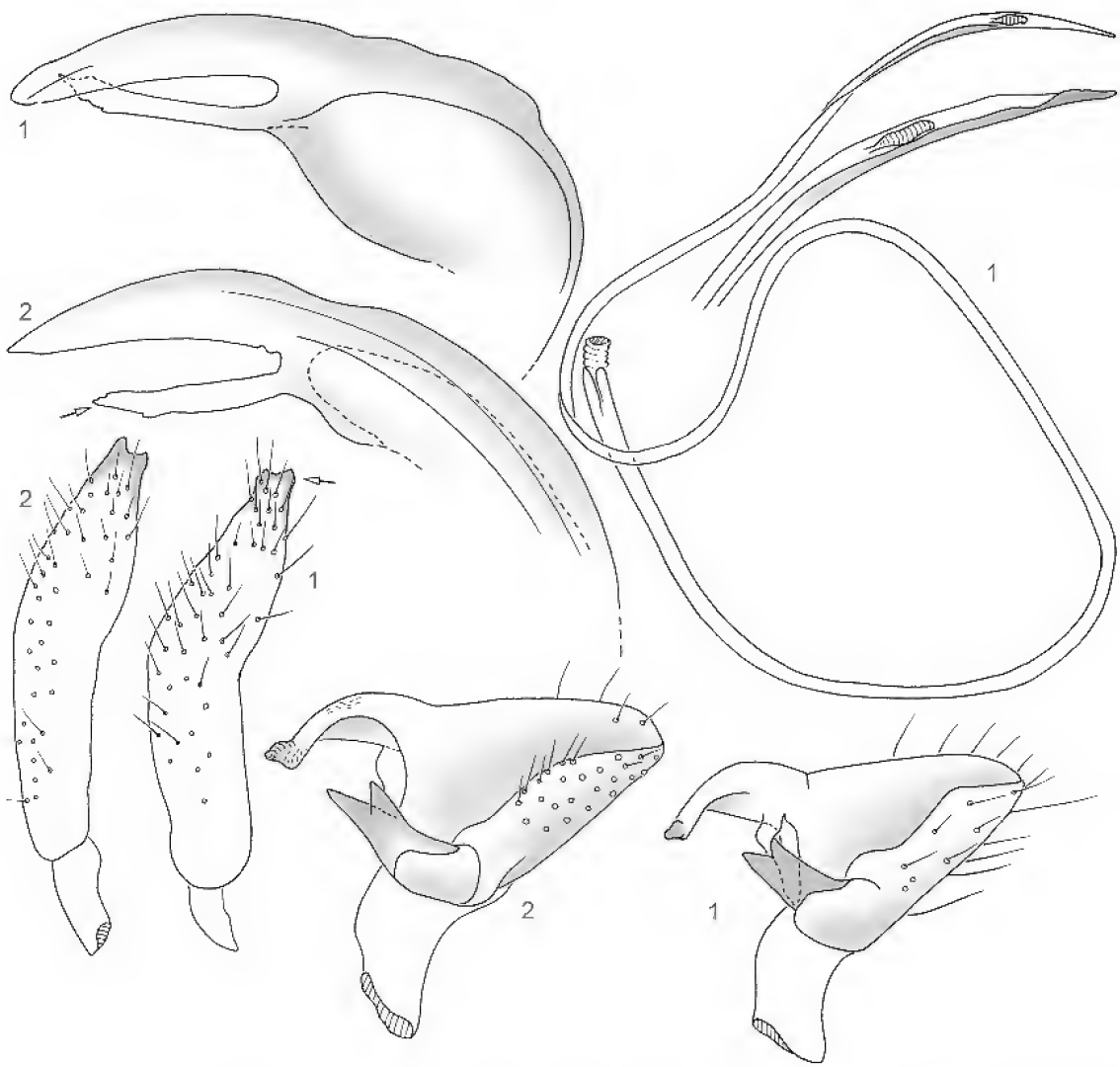


Fig. 12. *Bisulcopsallus texanus:* Male genitalia (male 1, AMNH_PBI 00068583; male 2, 00068573; entire vesica drawn at 50% scale of other structures).

total length 2.62–2.78, length apex clypeus–cuneal fracture 1.74–1.98, relatively broad bodied, width pronotum 0.87–1.00. COLORATION (fig. 1): Pale background coloration, coriaceous portion of hemelytra either without spots or partially to completely covered with orange to brown spots; membrane marmorate, with limited dark area posterior to cuneus, veins pale. SURFACE AND VESTITURE (figs. 1, 6D): As in generic description. STRUCTURE: Head: Labium reaching to posterior margin of middle trochanters. GENITALIA (figs. 12): Vesica: Long, filamentous. Phallotheca: Phallothecal spine flattened, reaching to near apex of phallotheca, with serrate apicoventral margin. Parameres: Left paramere with spines on anterior process divergent, posterior process not distinctly separated from paramere body; right paramere narrowed apically.

Female: Elongate ovoid; total length 2.45–2.81, length apex clypeus–cuneal fracture 1.75–1.87, width pronotum 0.90–0.94. COLORATION (fig. 1): As in male. SURFACE

AND VESTITURE: As in male. STRUCTURE: Similar to male. GENITALIA: Not examined.

HOST: Known from *Fraxinus cuspidata* Torr. and *Fraxinus* sp. (Oleaceae).

DISTRIBUTION (map 2): Ranging from Bexar County in west-central Texas to Cochise, Pima, and Santa Cruz Counties in southern Arizona.

DISCUSSION: The Arizona material was collected on *Fraxinus* spp. (Oleaceae); the host of the Texas specimens is unknown. The Texas specimens, from the "hill country" near San Antonio, show distinct and uniform spotting on the hemelytra, whereas those from Arizona have distinct spots only on the cuneus, with the corial spots indistinct in most specimens. The genitalia of a paratype male from the type locality and specimens from Arizona appear to be virtually identical, however, and I am therefore treating all of this material as a single species.

HOLOTYPE: **USA: Texas:** ***Bexar Co.:*** Helotes [29.57777°N 98.68972°W, 316 m], 01 Jul 1917, H.H. Knight, 1♂ (AMNH_PBI 00069805) (USNM).

PARATYPES: **USA: New Mexico:** ***Luna Co.:*** Deming, 32.26861°N 107.75806°W, 12 Jul 1917, H.H. Knight, Light Trap, 1♀ (AMNH_PBI 00068577) (USNM). **Texas:** ***Bexar Co.:*** Helotes, 29.57777°N 98.68972°W, 316 m, 01 Jul 1917, H.H. Knight, 1♂ (AMNH_PBI 00068573), 7♀ (AMNH_PBI 00068574–AMNH_PBI 00068576, AMNH_PBI 00068578, AMNH_PBI 00068579, AMNH_PBI 00068630, AMNH_PBI 00068632) (USNM).

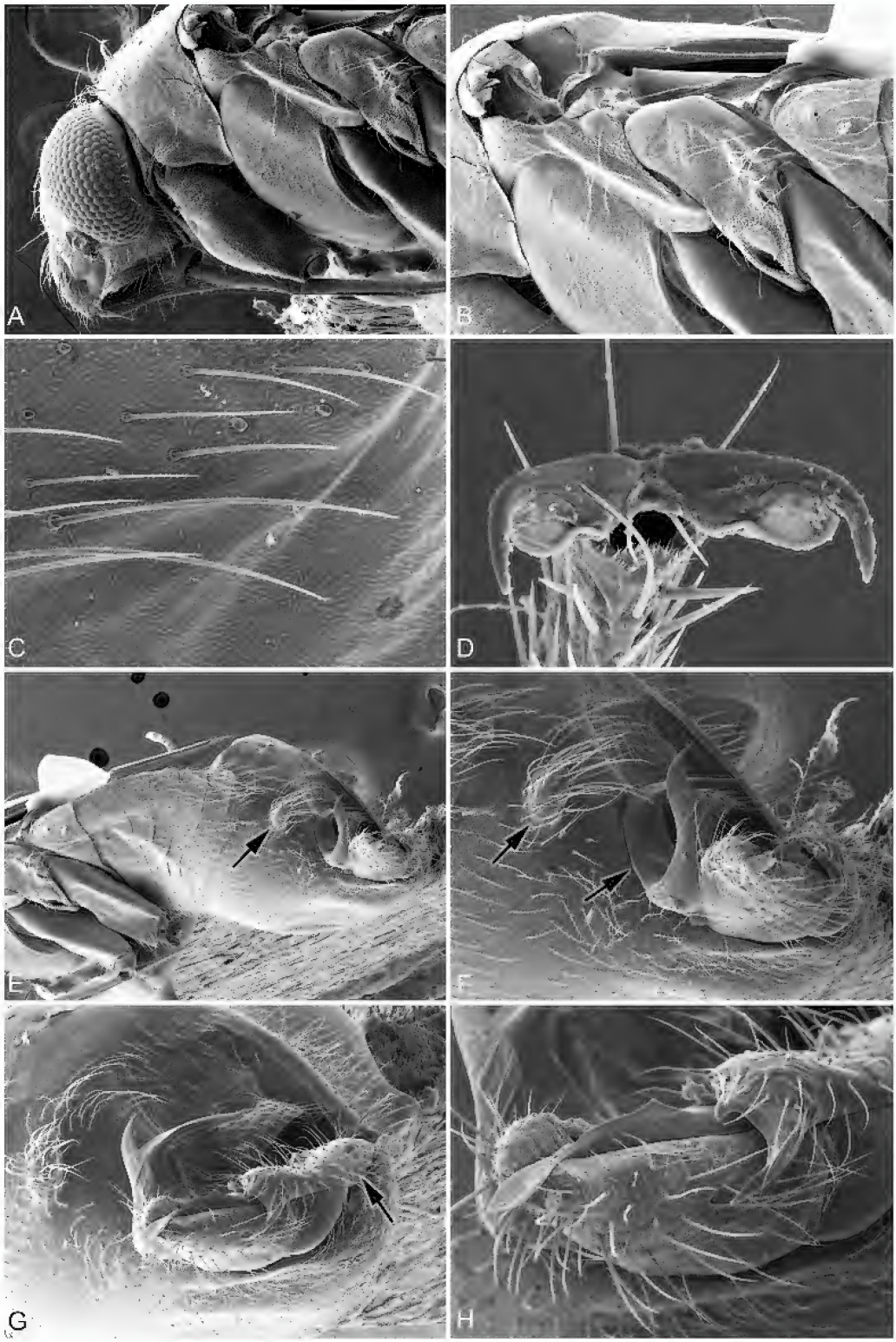
OTHER SPECIMENS EXAMINED: **USA: Arizona:** ***Cochise Co.:*** Ash Canyon Road, 0.5 mi W of Hwy 92, 31.38194°N 110.22444°W, 1554 m, 11 Jun 1992–20 Jul 1993, N. McFarland, 10♂ (AMNH_PBI 00062049, AMNH_PBI 00063069–AMNH_PBI 00063077) (USNM). ***Pima Co.:*** 4 mi N of Coronado Natl. Forest boundary on Mount Lemmon Rd, 32.36°N 110.7°W, 1219 m, 11 Jun 1983, Schuh, Schwartz, and Stonedahl, *Fraxinus cuspidata* (Oleaceae), 4♂ (AMNH_PBI 00063059–AMNH_PBI 00063061, AMNH_PBI 00063227), 6♀ (AMNH_PBI 00063062–AMNH_PBI 00063066, AMNH_PBI 00063228) (AMNH). Santa Catalina Mountains, Molino Basin, 32.5°N 110.92056°W, 01 Jun 1997, T.J. Henry and A.G. Wheeler, Jr., *Fraxinus* sp. (Oleaceae), 4♂ (AMNH_PBI 00032756, AMNH_PBI 00032779–AMNH_PBI 00032781), 8♀ (AMNH_PBI 00032782, AMNH_PBI 00068584–AMNH_PBI 00068590) (USNM). ***Santa Cruz Co.:*** Nogales, 31.34028°N 110.93361°W, 14 Apr 1989, T.J. Henry and A.G Wheeler, Jr., *Fraxinus* sp. (Oleaceae), 1♂ (AMNH_PBI 00068582) (USNM).

Ceratopsallus, new genus

Type species: *Ceratopsallus pintoi*, new species.

DIAGNOSIS: Recognized by the anterior process of the left paramere developed in the shape of cattle horns (figs. 14–23), in combination with the pale coloration, spotted dorsum in most specimens of most species (figs. 1, 2), the presence of one (or sometimes two) elongate spines arising from the ventral surface of the phallotheca, and the pygophore in male always very large, with a tubercle on the left side. Moderately small to large within the *Phymatopsallus* group, total length 2.39–3.70. Among other members of the *Phymatopsallus* group of genera with a spotted dorsum and pygophore with a tubercle on the left side, most easily confused with *Bisulcopsallus*, but readily distinguished by the apically bifurcate anterior process of the left paramere and the much longer, and always "filamentous", vesica in all species of that group. In addition to the above-mentioned characters, the elaborately developed vestibulum and the weak sexual dimorphism in the antennae and the eyes of most species allows for separation of *Angelopsallus*, *Bisulcopsallus*, and *Ceratopsallus* from other members of the *Phymatopsallus* group.

DESCRIPTION: *Male:* Size moderately small to large among *Phymatopsallus*-group taxa, elongate ovoid to nearly parallel-sided, total length 2.39–3.70, length apex clypeus–cuneal fracture 1.67–2.48, width pronotum 0.65–1.19. COLORATION (fig. 1): Body and forewings pale or faded green, sometimes weakly orange; membrane marmorate, usually with some conspicuous large dark areas, especially posterior to the cuneus; veins of membrane pale; corium, clavus, cuneus, and sometimes head, pronotum, and scutellum with heavy spotting of green, orange, or brown; eyes ranging from silvery or pale to nearly black; coloration of appendages pale, greenish, or weakly orange, femora with scattered, weak, brown spots; tibial spines dark with dark bases. SURFACE AND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VESTITURE (figs. 1, 2, 13C): Dorsal body surface smooth, impunctate, weakly shining. Dorsal vestiture of recumbent, silvery setae. STRUCTURE: Head: Weakly transverse, posterior margin of eyes contiguous with anterior margin of pronotum; posterior margin of vertex indistinct; frons weakly protruding beyond anterior margin of eyes; eyes in most species appearing as in female (fig. 2, e.g., *C. pintoi*), sometimes large in dorsal and lateral views (fig 2, e.g., *C. croceus*); antennae inserted above ventral margin of eye by roughly diameter of segment 1, insertion contiguous with eye (fig. 13A); antennal segment 2 usually weakly tapered and similar to female (fig. 2, *C. pintoi*), occasionally somewhat enlarged and cylindrical (fig. 2, *C. vauqueliniae*); labium reaching to hind trochanters or slightly beyond. Thorax: Mesothoracic spiracle and metathoracic scent-efferent system as in figure 13B. *Legs:* Claws strongly bent preapically, pulvilli flaplike, parempodia setiform (fig. 13D). Abdomen: Broad. GENITALIA (figs. 14–23): Pygophore: Very large, almost quadrangular, occupying at least half the length of abdomen, on left side with a distinct tubercle beset with numerous setae (fig. 13E, F). Vesica: Formed of a single strap, length varying from relatively short, moderately broad, and J-shaped to long, slender, and forming one complete loop, attenuated apically and extending beyond secondary gonopore by about 2 times length of gonopore; secondary gonopore relatively small, well sclerotized, ovoid, without gonopore sclerite. Phallotheca: Apical portion elongate, relatively slender, tapered, dorsal margin near apex sometimes with a triangular fold or keel, ventral margin always with an elongate, usually slender (sometimes flattened) spinelike process, anterodorsal or anteroventral surface sometimes with a second broader, elongate process, also arising at about midpoint of phallotheca. Parameres: Left paramere with anterior process uniquely developed in the shape of cattle horns, here referred to as left- and right-hand prongs as seen in figures 14–23, posterior process varying from relatively short, flattened, and straight to more elongate, slender, and decurved, always with a knoblike ornamentation apically; right paramere relatively large, elongate, nearly parallel-sided, apex with a distinct process on either side, sometimes asymmetrically developed, the left process being longer and fingerlike.

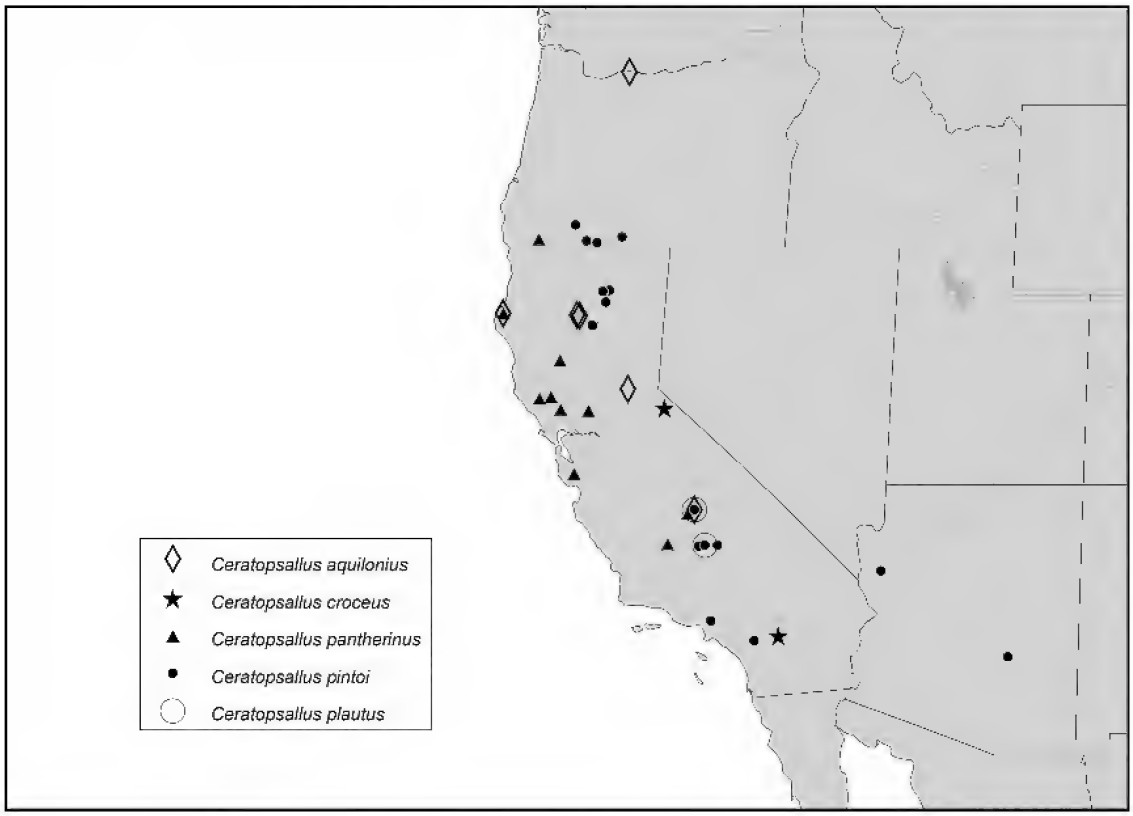
Female: Elongate ovoid; total length 2.39–3.18, length apex clypeus–cuneal fracture 1.68–2.32, width pronotum 0.71–1.09. COLORATION (fig. 1): As in male. SURFACE AND VESTITURE: As in male. STRUCTURE: Hemelytra extending just beyond apex of abdomen; eyes usually similar in size to those of male, more rarely eyes sexually dimorphic, those of males larger than those of females (fig. 2); antennal segment 2 tapered toward base. GENITALIA (figs. 15, 17, 18): Sclerotized rings more or less ovoid; vestibulum large, asymmetrical, lying on right side of body, entrance and exit closely apposed at base of ovipositor valves, medial portion of vestibulum forming a large "chamber" of nautiloid shape, at which point vestibulum doubles back on itself; posterior wall simple, without ornamentation (fig. 18).

ETYMOLOGY: From the Greek *keras*, horn, in reference to the cow horn-like formation of the anterior process of the left paramere, in combination with the generic name *Psallus*. Gender masculine.

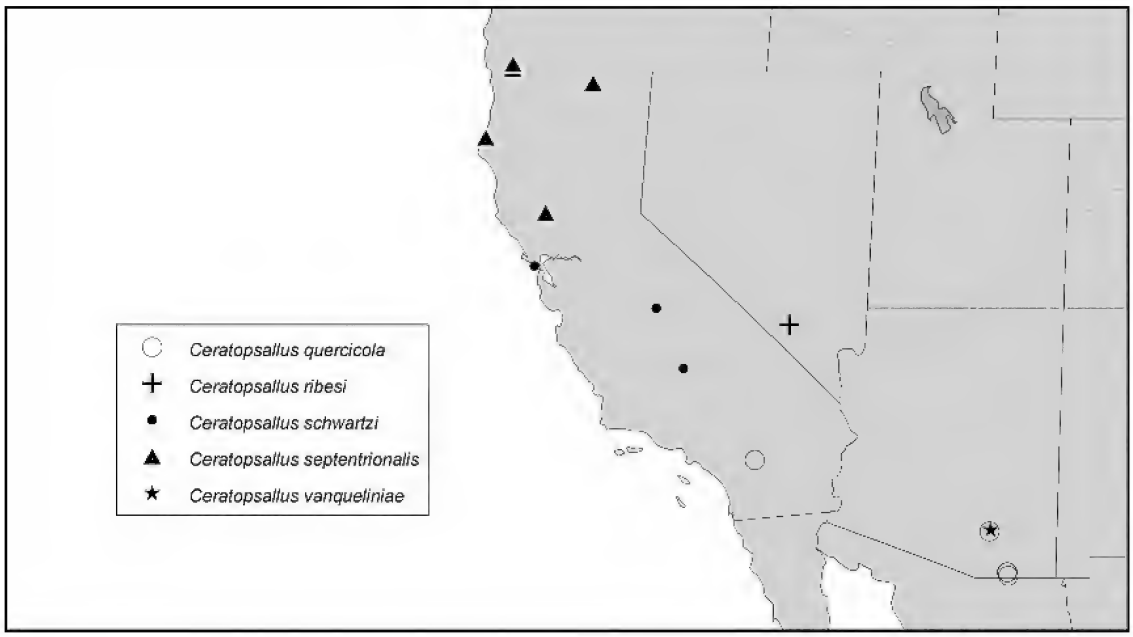
HOSTS: Several species known exclusively from *Arctostaphylos* spp. (Ericaceae) or *Quercus* spp. (Fagaceae). Also known from

←

Fig. 13. *Ceratopsallus aquilonius:* **A.** Lateral view of head. **B.** Mesothoracic spiracle and metathoracic scent-efferent system. **C.** Setae on hemelytron. **D.** Frontal view of pretarsus. **E.** Lateral view of male abdomen (arrow indicates tubercle on phygophore). **F.** Lateral view of male pygophore (left arrow indicates tubercle on phygophore; right arrow indicates cow horn development of anterior process of left paramere). **G.** Posterior view of male pygophore. **H.** Posterodorsal view of parameres and phallotheca.



Map 3. Distribution of *Ceratopsallus aquilonius–C. plautus*.



Map 4. Distribution of *Ceratopsallus quercicola–C. vauqueliniae*.

Ceanothus (Rhamnaceae) and a variety of other hosts, but with a lesser number of records.

DISCUSSION: Although the concepts for most of the species of *Ceratopsallus* recognized in the present paper appear to be relatively stable, it is clear that more species remain to be discovered in nature. Additional collecting, particularly in California, will undoubtedly reveal additional taxa and add to our knowledge of areas of endemism within the state.

KEY TO MALES OF *CERATOPSALLUS*

1. Phallotheca with two spines, one on ventral surface, the other usually on the anterodorsal surface (figs. 18, 21, 23). . 2
– Phallotheca with a single spine located on ventral surface (e.g., figs. 14, 16) 4
2. Posterior process of left paramere very long, smoothly curving in lateral view (figs. 18, 21); left paramere in lateral view extending well beyond right-hand prong of anterior process of paramere (figs. 18, 21); antennal segment 2 in males tapered, diameter less than that of antennal segment 1 over much of length 3
– Posterior process of left paramere relatively short, nearly straight in lateral view (fig. 23); body of left paramere in lateral view barely extending beyond right-hand prong of anterior process of paramere; antennal segment 2 in males cylindrical, of about same diameter as antennal segment 1; southern Arizona; *Vauquelinia* sp. . . . . *vauqueliniae*, n.sp.
3. Spine arising from anteroventral surface of phallotheca spatulate, greatly broadened and flattened on apical third (fig. 18); spots on hemelytra small, more or less uniformly distributed (fig. 2); southern Sierra Nevada, California; *Arctostaphylos* spp. . . . . *plautus*, n.sp.
– Process arising from anteroventral surface of phallotheca slender, not flattened and broad on apical third (fig. 21); spots on hemelytra clumped, forming a somewhat blotchy appearance (fig. 2); southern Sierra Nevada, California; *Arctostaphylos* spp. . . . . *schwartzi*, n.sp.
4. Eyes large, head broad (fig. 2); antennal segment 2 cylindrical, diameter about equal to that of segment 1; spotting on dorsum distinctly orange on a pale or weakly pink background 5
– Eyes not so large and head not so broad (fig. 2); antennal segment 2 tapered, diameter less than that of segment 1 over much of length; spotting on dorsum usually green or brown on a weekly greenish dorsum, much less frequently orange on a pale background 6
5. Antennal segment 2 very long, ranging from 1.4 to 1.7 times width of head (table 1); ventral spine on phallotheca slender, not flattened (fig. 15); apical processes on right paramere of unequal length, left process much longer than right (fig. 15); vesica very long and slender, forming a complete coil (fig. 15); southern California; *Platanus* sp. . . . . *croceus* (Van Duzee)
– Antennal segment 2 shorter, approximately 1.3 times width of head table 1); ventral spine on phallotheca flattened, broad in lateral view (fig. 16); apical processes on right paramere of equal length (fig. 16); vesica J-shaped, not forming a complete coil (fig. 16); southern Oregon to central California; *Quercus* spp. . . . . *pantherinus* (Van Duzee)
6. Posterior process of left paramere long and nearly straight in lateral view, extending over most of length beyond the left-hand prong of the anterior process of the left paramere (fig. 22); vesica long and slender, forming a complete coil (fig. 22); southern Oregon to central California; *Arctostaphylos* spp. . . . . *septentrionalis*, n.sp.
– Posterior process of left paramere much shorter, in lateral view extending only a short distance past left-hand prong of the anterior process of the left paramere (figs. 14, 17, 19, 20); vesica not so long and slender, usually J-shaped 7
7. Left-hand apical process of right paramere much longer than right (figs. 14, 17) . . 8
– Left-hand apical process of right paramere only slightly longer than right (figs. 19, 20) 9
8. Right-hand prong of anterior process of left paramere directed away from body of paramere; phallotheca in lateral view with a triangular projection on apicodorsal margin (fig. 17); southern Oregon to western Arizona; *Ceanothus* spp., *Cercocarpus* spp., etc. . . . . *pintoi*, n.sp.
– Right-hand prong of anterior process of left paramere nearly erect; phallotheca in lateral view with a ridgelike formation on apicodorsal margin (fig. 14); northern Ca-

lifornia, Oregon; *Quercus* spp.. . . . . *aquilonius*, n.sp.

9. Phallotheca with apex blunt and squared off, apicodorsal margin ornamented with a short keel (fig. 20); right-hand prong of anterior process of left paramere sinuously curving (fig. 20); southern Nevada; *Ribes* sp. . . . . *ribesi* (Knight)

– Phallotheca with apex more or less acuminate, apicodorsal margin with a triangular process in lateral view (fig. 19); right-hand prong of anterior process of left paramere smoothly curving (fig. 19); southern Arizona, southern California; *Arctostaphylos* sp., *Quercus* sp. . . . . *quercicola*, n.sp.

Ceratopsallus aquilonius, new species
figures 1, 14; map 3

DIAGNOSIS: Recognized by the weakly greenish background with gray brown, relatively small spots often covering the entire dorsum (although sometimes spots either faint or almost totally absent), the medium to large size among *Ceratopsallus* spp., average total length 3.06, the vesica of moderate length, not forming a loop, the phallotheca when viewed laterally with a keel-like ridge on apicodorsal margin and a single slender spine ventrally (fig. 14), the left paramere with left-hand prong of the anterior process long, sinuously curving, pointing toward the posterior process, the right-hand prong more or less smoothly curving, the posterior process of the left paramere relatively short and nearly straight, and the right paramere long and broad, the apical processes asymmetrically developed with the left process much longer than right. Similar to *C. pintoi*, new species, but apex of phallotheca distinct, *C. pintoi* always with a triangular development rather than a keel-like ridge on the apicodorsal margin.

DESCRIPTION: *Male:* Moderately small to medium-sized among *Ceratopsallus* spp., elongate ovoid, total length 2.81–3.37, length apex clypeus–cuneal fracture 1.91–2.21, width pronotum 0.77–0.98. COLORATION (fig. 1): Body and forewings pale or faded green; corium, clavus, and cuneus often with moderately dense covering of brownish spots, sometimes with spots restricted to cuneus and posterior portion of corium; eyes silvery or pale; coloration of appendages pale or greenish; membrane weakly to boldly marmorate, with a conspicuous large dark area posterior to the cuneus; veins of membrane pale. SURFACE AND VESTITURE (figs. 1, 13C): As in generic description. STRUCTURE: Head: Eyes lacking sexual dimorphism, vertex relatively broad, eyes occupying approximately two-thirds height of head; antennal segment 2 weakly tapered proximally (fig. 1); labium long, surpassing hind trochanters by a short distance. GENITALIA (figs. 14): Vesica: Moderately long, relatively broad, forming one open loop. Phallotheca: When viewed laterally bearing a keel-like ridge on apicodorsal margin, spine on ventral margin slender. Parameres: Left paramere with left-hand prong of anterior process long, sinously curving, pointing toward posterior process, right-hand prong more or less smoothly curving, posterior process relatively short and nearly straight; right paramere long and broad, apical processes asymmetrically developed with left process much longer than right.

Female: Elongate ovoid; total length 2.73–3.18, length apex clypeus–cuneal fracture 1.88–2.25, width pronotum 0.84–1.06. COLORATION (fig. 1): As in male. SURFACE AND VESTITURE: As in male. STRUCTURE: Hemelytra just covering abdomen; eyes usually similar in size to those of male (figs. 1); antennal segment 2 tapered toward base. GENITALIA (genitalia examined; not illustrated): See generic description.

ETYMOLOGY: Named for its distribution; from the Latin, *aquilonius*, northern.

HOST: Recorded from *Quercus douglasii* H. & A. and *Quercus* sp. (Fagaceae) on the west slopes of the northern Sierra Nevada Mountains, California.

DISTRIBUTION (map 3): Ranging from Hood River County, Oregon, in the north, south through Trinity, Shasta, and Tulare Counties in northern California, with a single record from the east side of the Sierra Nevada Mountains in Inyo County, California.

HOLOTYPE: **USA: California: *Shasta Co.:*** Palo Cedro [40.56361°N 122.23888°W, 143 m], 16 Jun 1959, Kelton and Madge, *Quercus* sp. (Fagaceae), 1♂ (AMNH_PBI 00071906) (CNC).

PARATYPES: **USA: California: *Inyo Co.:*** E side of California Rt 141, 39.00944°N 120.76972°W, 1524 m, 15 Jul 1982, J.T. Polhe-

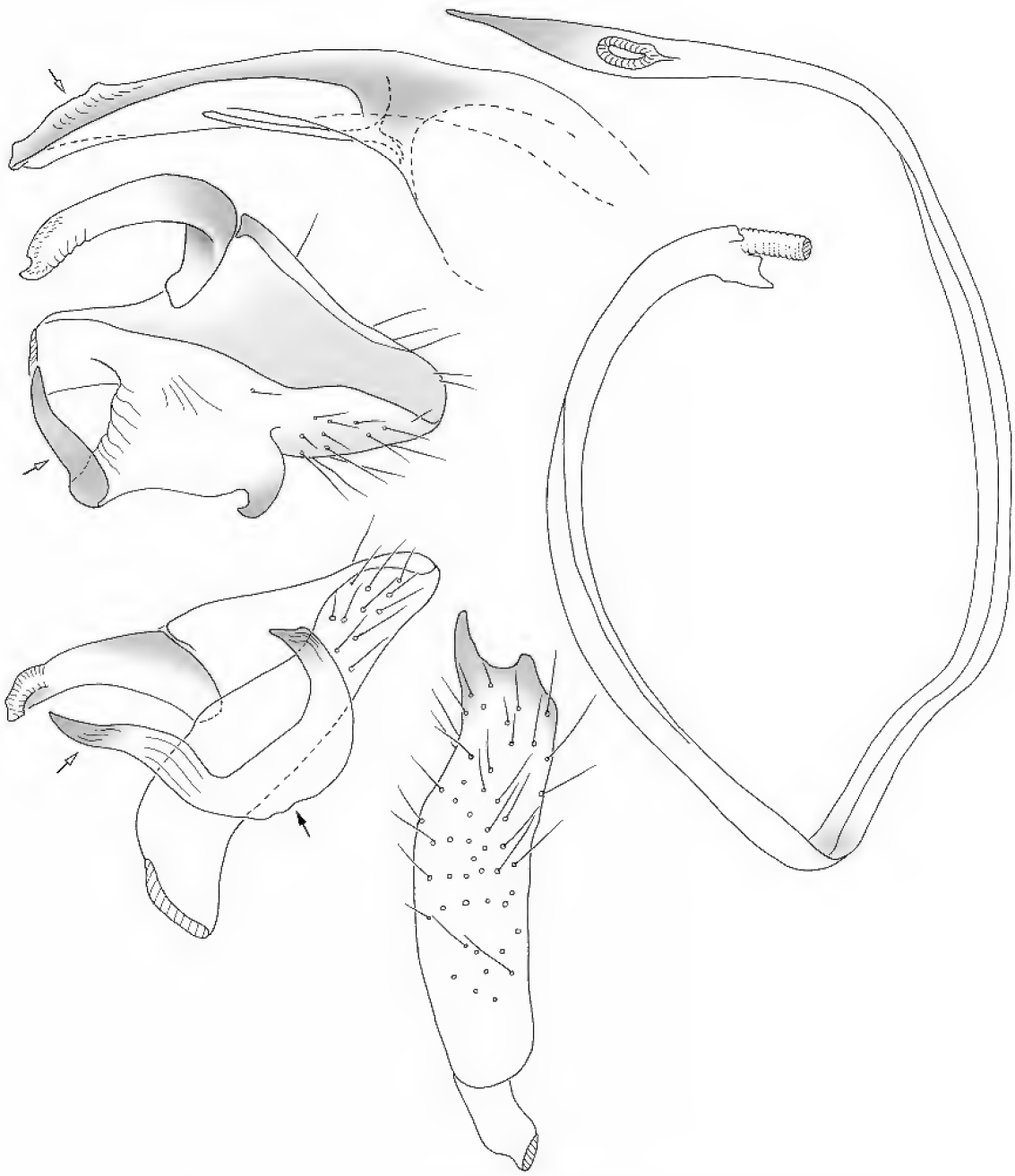


Fig. 14. *Ceratopsallus aquilonius:* Male genitalia (AMNH_PBI 00071636).

mus, 1♂ (AMNH_PBI 00063962), 1♂ (AMNH_PBI 00063970) (JTP). ***Shasta Co.:*** Millville, 40.54944°N 122.17417°W, 16 Jun 1959, Kelton and Madge, 1♂ (AMNH_PBI 00071715) *Quercus* sp. (Fagaceae), 2♂ (AMNH_PBI 00071719, AMNH_PBI 00071905), 1♀ (AMNH_PBI 00071911) (AMNH). 4♂ (AMNH_PBI 00071714, AMNH_PBI 00071716–AMNH_PBI 00071718), 8♀ (AMNH_PBI 00071736–AMNH_PBI 00071739, AMNH_PBI 00071771–

AMNH_PBI 00071774) (CNC); 15 Jun 1959, Kelton and Madge, *Quercus* sp. (Fagaceae), 1♂ (AMNH_PBI 00071712), 1♀ (AMNH_PBI 00071751) (AMNH). 17♂ (AMNH_PBI 00071713, AMNH_PBI 00071720–AMNH_PBI 00071735), 30♀ (AMNH_PBI 00071740–AMNH_PBI 00071750, AMNH_PBI 00071752–AMNH_PBI 00071770) (CNC). Palo Cedro, 40.56361°N 122.23888°W, 143 m, 16 Jun 1959, Kelton and Madge, *Quercus* sp. (Fagaceae), 2♂ (AMNH_PBI 00071634, AMNH_PBI 00071635), 2♀ (AMNH_PBI 00071650, AMNH_PBI 00071651) (AM). 2♂ (AMNH_PBI 00071878, AMNH_PBI 00071904), 4♀ (AMNH_PBI 00071908–AMNH_PBI 00071910, AMNH_PBI 00071912) (AMNH). 43♂ (AMNH_PBI 00071617–AMNH_PBI 00071633, AMNH_PBI 00071636, AMNH_PBI 00071637, AMNH_PBI 00071670–AMNH_PBI 00071693), 42♀ (AMNH_PBI 00071638–AMNH_PBI 00071649, AMNH_PBI 00071652–AMNH_PBI 00071669, AMNH_PBI 00071694–AMNH_PBI 00071705) (CNC). ***Trinity Co.:*** Van Duzen Road, 40.59833°N 124.15611°W, 05 Aug 1951, Bliven, 1♂ (AMNH_PBI 00077237) (CAS). ***Tulare Co.:*** Mineral King Rd E of Three Rivers, 36.47356°N 118.8465°W, 492 m, 24 May 2004, Schuh, Cassis, Schwartz, Weirauch, Wyniger, Forero, *Quercus douglasii* (Fagaceae), det. Field ID, 14♂ (AMNH_PBI 00170585–AMNH_PBI 00170598), 5♀ (AMNH_PBI 00170599–AMNH_PBI 00170603) (AMNH). **Oregon:** ***Hood River Co.:*** Hood River, 45.71556°N 121.51°W, 17 Jul 1931, R.H. Beamer, 2♂ (AMNH_PBI 00074866, AMNH_PBI 00074867) (KU).

Ceratopsallus croceus (Van Duzee), new combination
figures 2, 15; map 3

Psallus croceus Van Duzee, 1918: 302 (n.sp.).

DIAGNOSIS: Recognized by the weakly pinkish background coloration with conspicuous orange spots covering the entire dorsum (fig. 2), the relatively large size among *Ceratopsallus* spp., the average length 3.42, the distinct sexual dimorphism (males with larger eyes than females and cylindrical antennal segment 2), and the structure of the male genitalia, the vesica being moderately long (fig. 15), the phallotheca with a slender spine on the ventral surface, the left paramere with the right-hand prong of the anterior process erect and nearly straight, and the right paramere with the apical processes unequally developed, with the left process being distinctly longer than the right (fig. 15). Most similar to *C. pantherinus* (Van Duzee) in the large eyes, cylindrical second antennal segment, and the pink-orange spots on the dorsum, but that species with antennal segment 2 much shorter, the vesica much longer, the ventral phallothecal spine flattened, and the right paramere with the apical processes of more or less equal length.

REDESCRIPTION: *Male:* Moderately large among *Ceratopsallus* spp., elongate, nearly parallel-sided, total length 3.15–3.70, length apex clypeus–cuneal fracture 2.19–2.48, width pronotum 0.98–1.19. COLORATION (fig. 1): Body and forewings pinkish; entire dorsum with a moderately dense covering of orange spots; eyes silvery or pale; coloration of appendages pale or weakly orange; membrane weakly to boldly marmorate, with a conspicuous large dark area posterior to the cuneus; veins of membrane pale. SURFACE AND VESTITURE (figs. 2, 13C): As in generic description. STRUCTURE: Head: Eyes sexually dimorphic, large, vertex relatively narrow (fig. 2), eyes occupying nearly entire height of head; antennal segment 2 cylindrical, of uniform diameter over entire length, very long, length well more that 1.5 times width of head (ratio 1.06:0.73); labium long, surpassing hind trochanters by a short distance. GENITALIA (figs. 15): Vesica: Moderately long, slender, roughly J-shaped. Phallotheca: When viewed laterally bearing a short keel-like ridge on apicodorsal margin, spine on ventral margin slender, relatively long. Parameres: Left paramere with right-hand prong of anterior process very long, erect, nearly straight over much of length, left-hand prong relatively broad curving toward posterior process, posterior process of moderate length, nearly straight in lateral view, curving in dorsal view; right paramere long and broad, apical processes asymmetrically developed with left process much longer than right.

Female: Elongate ovoid; total length 3.03, length apex clypeus–cuneal fracture 2.11–2.22, width pronotum 0.96–1.01. COLORATION (fig. 2): As in male. SURFACE AND VESTITURE: As in male. STRUCTURE: Hemelytra extending just beyond apex of

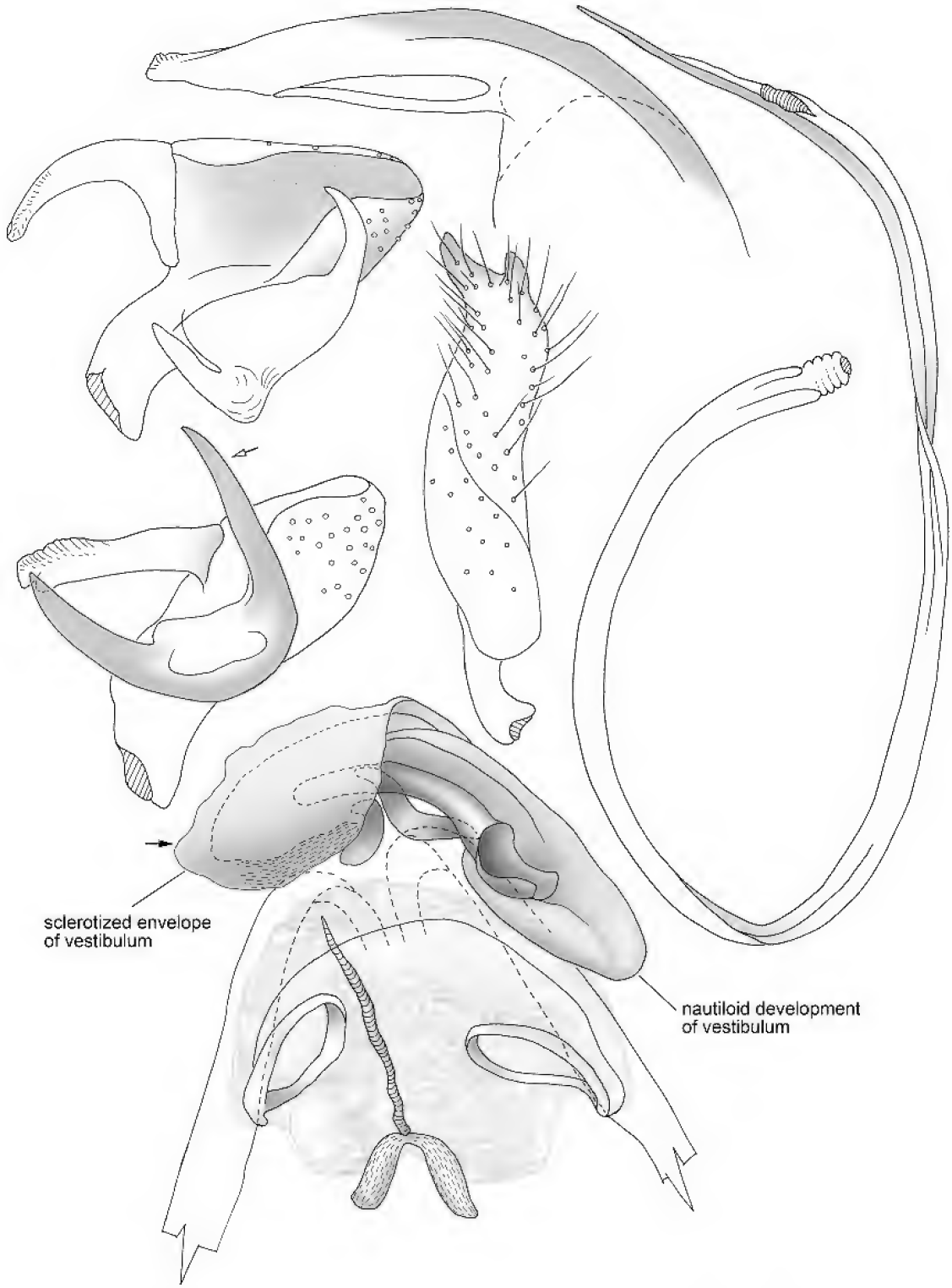


Fig. 15. *Ceratopsallus croceus:* Male genitalia (AMNH_PBI 00074847); female genitalia (AMNH_PBI 00074878).

abdomen; eyes smaller than in male; antennal segment 2 tapered toward base. GENITALIA (fig. 15): See generic description.

HOST: Sycamore (*Platanus* sp.) (Platanaceae) (Van Duzee, 1918).

DISTRIBUTION (map 3): Known from Riverside and Alpine Counties, California.

DISCUSSION: Van Duzee (1918) described *Psallus croceus* from material "taken on a sycamore tree in Andreas' Canyon at Palm Springs, Calif." In his description he indicated that the right paramere was "long, curved and tapered, transverse, reaching across the genital segment". He did not mention the tubercle on the left side of the pygophore, although examination of the holotype indicates that it is present.

HOLOTYPE: **USA: California: *Riverside Co.:*** Palm Springs [33.83028°N 116.54444°W], 18 May 1917–20 May 1917, E.P. Van Duzee, 1♂ (AMNH_PBI 00077829) (CAS).

PARATYPES: **USA: California: *Riverside Co.:*** Palm Springs, 33.83028°N 116.54444°W, 18 May 1917–20 May 1917, E.P. Van Duzee, 3♂ (AMNH_PBI 00077247–AMNH_PBI 00077249), 2♀ (AMNH_PBI 00077134, AMNH_PBI 00077135) (CAS). 1♂ (AMNH_PBI 00068782) (USNM).

OTHER SPECIMENS EXAMINED: **USA: California: *Alpine Co.:*** Alpine, 38.6°N 119.8°W, 09 Jul 1929, R.H. Beamer, 2♂ (AMNH_PBI 00074863, AMNH_PBI 00074864) (AMNH). 4♂ (AMNH_PBI 00074847, AMNH_PBI 00074860–AMNH_PBI 00074862), 2♀ (AMNH_PBI 00074955, AMNH_PBI 00074956) (KU).

Ceratopsallus pantherinus (Van Duzee), new combination
figures 2, 16; map 3

Psallus pantherinus Van Duzee, 1917: 279 (n.sp.).

DIAGNOSIS: Recognized by the weakly pinkish background with conspicous orange spots covering the entire dorsum (fig. 2), the relatively large size among *Ceratopsallus* spp., the average length 3.48, the distinct sexual dimorphism (males with larger eyes than females and cylindrical antennal segment 2), and the structure of the male genitalia, with the vesica being very long compared to other *Ceratopsallus* spp., the phallotheca with a flattened spine on the ventral surface, the left paramere with the right-hand prong of the anterior process smoothly curving, and the right paramere with the apical processes more or less equally developed (fig. 16). Most similar to *C. croceus* (Van Duzee) in the large eyes and the pink-orange spots on the dorsum, but that species with antennal segment 2 much longer, the vesica much shorter, the ventral vesical spine slender, and the right paramere with the apical processes of unequal length.

REDESCRIPTION: *Male:* Moderately large among *Ceratopsallus* spp., elongate, nearly parallel-sided, total length 3.42–3.55, length apex clypeus–cuneal fracture 2.23–2.32, width pronotum 1.05–1.09. COLORATION (fig. 2): Body and forewings weakly pinkish; entire dorsum with moderately dense covering of orange spots; eyes silvery to red in available specimens; coloration of appendages pale or weakly orange; membrane weakly to boldly marmorate, with a large dark area posterior to the cuneus; veins of membrane pale. SURFACE AND VESTITURE (figs. 2, 13C): As in generic description. STRUCTURE: Head: Eyes sexually dimorphic, large, vertex relatively narrow (fig. 2), eyes occupying nearly entire height of head; antennal segment 2 cylindrical, of uniform diameter over entire length, relatively short, length about one-third greater than width of head (0.90:0.70); labial apex obscured in all available specimens. GENITALIA (figs. 16): Vesica: Very long, filamentous, forming 2 complete coils (drawn to 50% of scale of congeners). Phallotheca: When viewed laterally with a broadly flattened apex, spine on ventral margin flattened, relatively long. Parameres: Left paramere with relatively short body, right-hand prong of anterior process smoothly curving and tapered toward apex, left-hand prong relatively short and narrow, posterior process relatively short, straight in lateral view, curving in dorsal view; right paramere moderately long and broad, apical processes symmetrically developed, of more or less equal length.

Female: Elongate ovoid; total length 3.02–3.10, length apex clypeus–cuneal fracture 2.06–2.10, width pronotum 0.92–0.96. COLORATION (fig. 2): As in male. SURFACE AND VESTITURE: As in male. STRUC-

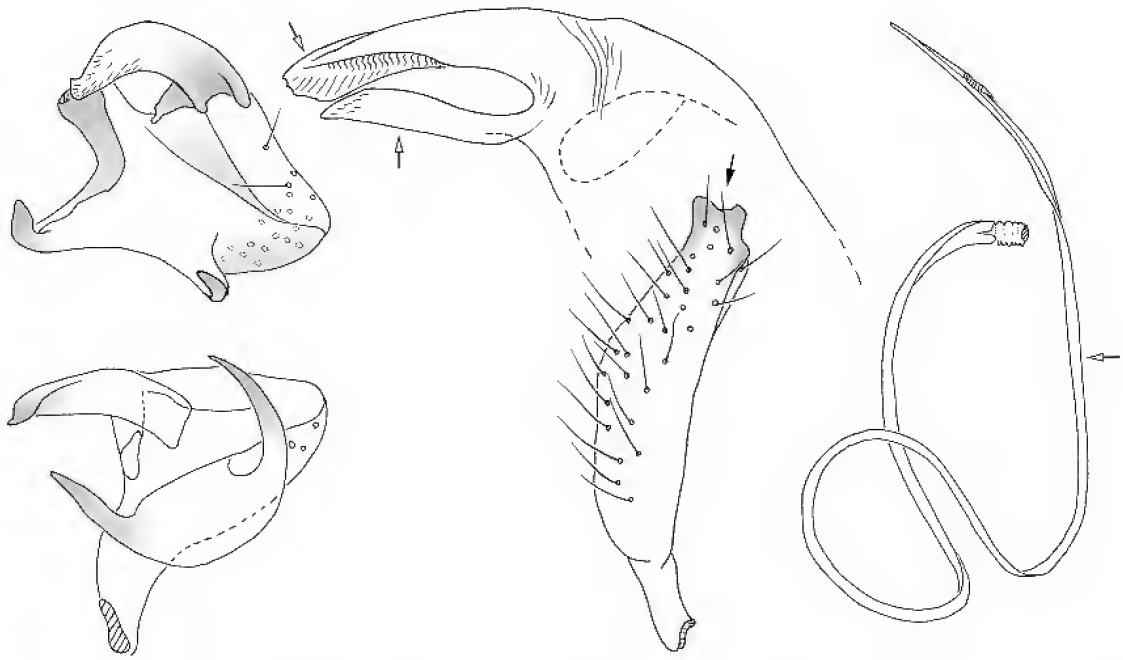


Fig. 16. *Ceratopsallus pantherinus:* Male genitalia (AMNH_PBI 00077250; vesica drawn at 50% scale of other structures).

TURE: Hemelytra just covering abdomen; eyes smaller than in those of male, vertex relatively broad (figs. 2); antennal segment 2 tapered toward base. GENITALIA: Not examined.

HOST: Recorded from *Quercus chrysolepis* Liebm. and *Q. lobata* Née (Fagaceae).

DISTRIBUTION (map 3): Distributed from Josephine County in southern Oregon and south through the northern coastal mountains to the foothills of the southern Sierra Nevada Mountains in California.

DISCUSSION: Van Duzee (1917) indicated that he had described this species on the basis of specimens taken on *Quercus agrifolia* Née near Cloverdale, Sonoma County, California, and other material taken near Hoberg's Resort, Lake County, California. He also mentioned having a single specimen from Manitou, Colorado. Van Duzee (1917) did not say whether the Hoberg Resort material was also taken on *Quercus agrifolia.* I have examined the Manitou, Colorado, specimen; it belongs to *Bisulcopsallus polhemorum*, n.sp.

HOLOTYPE: **USA: California: *Sonoma Co.:*** Cloverdale [38.80546°N 123.01722°W, 101 m], 03 Aug 1916, E.P. Van Duzee, 1♂ (AMNH_PBI 00077844) (CAS).

PARATYPES: **USA: California: *Lake Co.:*** Hobergs, near, 38.84351°N 122.72443°W, 924 m, 02 Aug 1916, E.P. Van Duzee, 1♂ (AMNH_PBI 00068637) (CAS). ***Sonoma Co.:*** Cloverdale, 38.80546°N 123.01722°W, 101 m, 03 Aug 1916, E.P. Van Duzee, 1♂ (AMNH_PBI 00077138), 2♀ (AMNH_PBI 00077139, AMNH_PBI 00077140) (CAS).

OTHER SPECIMENS EXAMINED: **USA: California: *Glenn Co.:*** 2 mi W of Elk Creek, 39.60027°N 122.57407°W, 07 Jun 1984, J.D. Pinto, *Quercus* sp. (Fagaceae), 4♂ (AMNH_PBI 00083881–AMNH_PBI 00083884) (UCR). ***Kern Co.:*** Poso Creek, 35.74596°N 119.46998°W, 05 Jun 1929, E.P. Van Duzee, 1♂ (AMNH_PBI 00077807), 2♀ (AMNH_PBI 00077811, AMNH_PBI 00077812) (CAS); 05 Jun 1929, R.L. Usinger, 4♂ (AMNH_PBI 00077806, AMNH_PBI 00077808–AMNH_PBI 00077810) (CAS). ***Napa Co.:*** 2 mi NNE of Angwin, on N side of Howell Mountain, 38.57583°N 122.44889°W, 396 m, 01 Jun 1978, H.B. Leach, 1♂ (AMNH_PBI 00077250) (CAS). ***Santa Clara Co.:*** Los Gatos, 37.22638°N 121.97444°W, 103 m, 01 Aug 1933, J.A. Kusche, 2♂ (AMNH_PBI 00077251, AMNH_PBI 00077252), 2♂ (AMNH_PBI 00077136, AMNH_PBI 00077137) (CAS). ***Trinity Co.:*** Van Duzen

Road, 40.59833°N 124.15611°W, 05 Aug 1951, Bliven, 1♂ (AMNH_PBI 00077257) (CAS). ***Tulare Co.:*** Lemoncove, 36.38278°N 119.02361°W, 26 Jul 1929, R.H. Beamer, 1♂ (AMNH_PBI 00074953) (KU). ***Yolo Co.:*** Davis, 38.545°N 121.73944°W, 09 Aug 1998, A.G. Wheeler, Jr., *Quercus lobata* (Fagaceae), 2♂ (AMNH_PBI 00069412, AMNH_PBI 00069413) (USNM). **Oregon:** ***Josephine Co.:*** 11 miles E Cave Junction, Grayback Campground, 42.16285°N 123.43193°W, 09 Aug 1979, G. Stonedahl, *Quercus chrysolepis* (Fagaceae), 4♂ (AMNH_PBI 00062824–AMNH_PBI 00062827) (AMNH).

Ceratopsallus pintoi, new species
figures 2, 17; map 3

DIAGNOSIS: Recognized by the weakly greenish background with gray brown, relatively small spots covering the hemelytra or the entire dorsum (fig. 2), the moderate size among *Ceratopsallus* spp., the average total length 3.00, and the structure of the male genitalia, the vesica moderately long, the phallotheca when viewed laterally with a triangular projection on the apicodorsal margin and a single slender spine ventrally (fig. 17), the left paramere with the left-hand prong of the anterior process long and sinuously curving, the right-hand prong also curving and projecting laterally away from the paramere body, the posterior process of the left paramere of moderate length, nearly straight, the right paramere with the apical processes asymmetrically developed, the left-hand process much longer than right. Similar to *C. aquilonius*, new species, but apex of phallotheca distinct, *C. aquilonius* always with a keel-like development rather that a triangular projection on the apicodorsal margin.

DESCRIPTION: *Male:* Size moderate to large among *Ceratopsallus* spp., elongate ovoid, total length 2.50–3.47, length apex clypeus–cuneal fracture 1.76–2.24, width pronotum 0.86–1.02. COLORATION (fig. 2): Body and forewings faded green, often pale in preserved specimens; entire dorsum with moderately dense covering of greenish to brownish spots; eyes silvery to weakly reddish; coloration of appendages pale or greenish; membrane boldly marmorate, with a weakly developed continuous dark area posterior to the cuneus; veins of membrane pale. SURFACE AND VESTITURE (figs. 2, 13C): As in generic description. STRUCTURE: Head: Eyes lacking sexual dimorphism, vertex relatively broad (fig. 2), eyes occupying approximately two-thirds height of head; antennal segment 2 weakly tapered proximally (fig. 2); labium long, reaching hind trochanters, or surpassing them by a short distance. GENITALIA (figs. 17): Vesica: Moderately long, forming one complete loop. Phallotheca: When viewed laterally, with a triangular projection on the apicodorsal margin and a single slender spine on ventral margin. Parameres: Left paramere with left-hand prong of anterior process long and sinuously curving, right-hand prong also curving and projecting laterally away from the paramere body, posterior process of moderate length, nearly straight; right paramere with apical processes asymmetrically developed, the left process much longer than right.

Female: Elongate ovoid; total length 2.52–3.24, length apex clypeus–cuneal fracture 1.79–2.24, width pronotum 0.85–0.98. COLORATION (fig. 2): As in male. SURFACE AND VESTITURE: As in male. STRUCTURE: Hemelytra extending just beyond apex of abdomen; eyes usually similar in size to those of male (figs. 2); antennal segment 2 tapered toward base. GENITALIA (fig. 17): See generic description.

ETYMOLOGY: Named for John D. Pinto, who during his tenure as a professor of entomology at the University of California, Riverside, collected and documented hosts for this and many other species of Miridae from California and Arizona.

HOST: Recorded from *Amelanchier alnifolia* (Nutt.) Nutt., *Cercocarpus betuloides* Nutt., *C. ledifolius* Nutt., and *Purshia tridentata* (Pursh.) DC (Rosaceae), *Ceanothus cordulatus* Kellogg, *C. crassifolius* Torr., *C. greggii vestitus* (Greene) McMinn, and *C. cuneatus* (Hook.) Nutt. (Rhamnaceae), *Eriodictyon angustifolium* Nutt. (Hydrophyllaceae), and *Quercus* sp. (Fagaceae).

DISTRIBUTION (map 3): Widely distributed from Jackson and Klamath Counties in southern Oregon, south to Los Angeles and Riverside Counties in California, and east to Gila and Mohave Counties, Arizona.

DISCUSSION: Based on available records, this is the most widespread species of

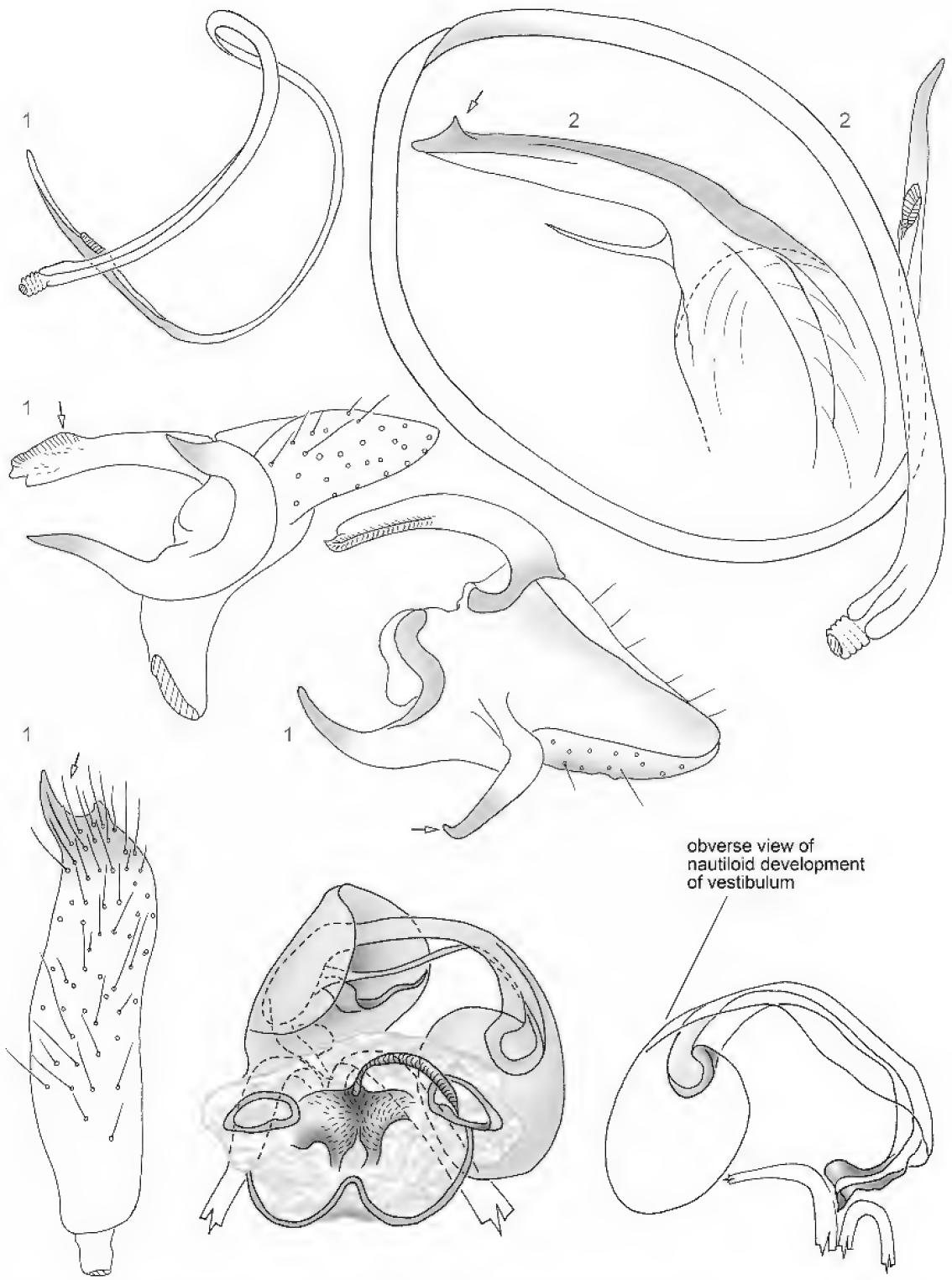


Fig. 17. *Ceratopsallus pintoi:* Male genitalia (male 1, AMNH_PBI 00082262, vesica drawn at 50% scale of other structures; male 2, AMNH_PBI 00063239;); female genitalia (AMNH_PBI 00082902).

Ceratopsallus, in terms of both geography and host preference. Nonetheless, the male genitalia are remarkably consistent in structure across the entire range of the taxon as here construed.

HOLOTYPE: **USA: Arizona: *Gila Co.:*** Old CCC Campground S of Globe on Pioneer Pass Rd [33.39417°N 110.78583°W], 1433 m, 30 May 1983–31 May 1983, R.T. Schuh, G.M. Stonedahl, B.M. Massie, *Eriodictyon angustifolium* Nutt. (Hydrophyllaceae), 1♂ (AMNH_PBI 00063242) (AMNH).

PARATYPES: **USA: Arizona: *Gila Co.:*** Old CCC Campground S of Globe on Pioneer Pass Rd, 33.39417°N 110.78583°W, 1433 m, 30 May 1983–31 May 1983, R.T. Schuh, G.M. Stonedahl, B. M. Massie, *Eriodictyon angustifolium* Nutt. (Hydrophyllaceae), 14♂ (AMNH_PBI 00063240, AMNH_PBI 00063318–AMNH_PBI 00063330), 5♀ (AMNH_PBI 00063243, AMNH_PBI 00063331–AMNH_PBI 00063334) (AMNH). ***Mohave Co.:*** Hualapai Mountains, SE of Kingman, T20N R15W, 35.18944°N 114.05222°W, 1585 m, 09 Jun 1983, R.T. Schuh, M.D. Schwartz, G.M. Stonedahl, *Quercus* sp. (Fagaceae), 6♂ (AMNH_PBI 00063302, AMNH_PBI 00063306–AMNH_PBI 00063310), 5♀ (AMNH_PBI 00063313–AMNH_PBI 00063317) *Ceanothus greggii vestitus* (Greene) McMinn (Rhamnaceae), 8♂ (AMNH_PBI 00063238, AMNH_PBI 00063239, AMNH_PBI 00063241, AMNH_PBI 00063303–AMNH_PBI 00063305, AMNH_PBI 00063311, AMNH_PBI 00063312), 3♀ (AMNH_PBI 00063129, AMNH_PBI 00063244, AMNH_PBI 00063245) (AMNH). **California: *Kern Co.:*** 20 km W of Wofford Heights on Rt 155, 35.70694°N 118.6764°W, 1500 m, 26 Jul 1999, M.D. Schwartz, *Cercocarpus betuloides* (Rosaceae), 2♂ (AMNH_PBI 00071708, AMNH_PBI 00071709) (AMNH). *Cercocarpus betuloides* (Rosaceae), 1♂ (AMNH_PBI 00071707) (CNC). 44.6 km E of jct with Rt 65 on Rt 155, W of Glennville, 35.72889°N 118.20954°W, 1000 m, 26 Jul 1999, M.D. Schwartz, *Cercocarpus betuloides* (Rosaceae), 1♂ (AMNH_PBI 00071706) (CNC). 7 km W of Wofford Heights on Rt 155, 35.725°N 118.52555°W, 1520 m, 26 Jul 1999, Schwartz, Gillespie, Quiring, *Ceanothus cordulatus* Kell. (Rhamnaceae), 1♂ (AMNH_PBI 00071710), 1♀ (AMNH_PBI 00071711) (AMNH). *Ceanothus cordulatus* Kell. (Rhamnaceae), 1♂ (AMNH_PBI 00071907) (CNC). ***Los Angeles Co.:*** Glendale, 34.1425°N 118.25417°W, 12 Jul 1948, E.I. Schlinger, 1♂ (AMNH_PBI 00074608) (UCD). ***Riverside Co.:*** Menifee Valley, hills on W end, 33.72833°N 117.14556°W, 549 m, 13 Jun 1979–20 Jun 1979, J.D. Pinto, *Ceanothus crassifolius* (Rhamnaceae), 22♂ (AMNH_PBI 00068485, AMNH_PBI 00068486, AMNH_PBI 00082260–AMNH_PBI 00082279), 24♀ (AMNH_PBI 00082280, AMNH_PBI 00082876–AMNH_PBI 00082880, AMNH_PBI 00082889–AMNH_PBI 00082906) (UCR); 04 Jun 1979–20 Jun 1979, J.D. Pinto, *Ceanothus crassifolius* (Rhamnaceae), 5♂ (AMNH_PBI 00082297–AMNH_PBI 00082301), 4♀ (AMNH_PBI 00082302–AMNH_PBI 00082305) (UCR). ***Shasta Co.:*** 1 mi W of Fall River Mills, 41.08058°N 121.46683°W, 1030 m, 07 Jul 1979, R.T. and Joe Schuh, *Ceanothus cuneatus* (Pursh.) DC (Rhamnaceae), 15♂ (AMNH_PBI 00062768–AMNH_PBI 00062781, AMNH_PBI 00063258), 7♀ (AMNH_PBI 00062782–AMNH_PBI 00062787, AMNH_PBI 00063168) (AMNH). Brown Butte, 40.83472°N 121.52861°W, 07 Jul 1947, R.L. Usinger, 4♂ (AMNH_PBI 00079113–AMNH_PBI 00079116) (UCB). Cayton, 41.06194°N 121.63278°W, 19 Jul 1918–20 Jul 1918, E.P. Van Duzee, 2♂ (AMNH_PBI 00077814, AMNH_PBI 00077815), 6♀ (AMNH_PBI 00077816–AMNH_PBI 00077821) (CAS). ***Tehama Co.:*** 10 mi W of Mineral, 40.34762°N 121.78405°W, 27 Jun 1966, O'Brien, 1♂ (AMNH_PBI 00079112) (UCB). 12 mi W of Mineral, 40.34756°N 121.82208°W, 27 Jun 1967, C.W. O'Brien, 4♂ (AMNH_PBI 00079108–AMNH_PBI 00079111) (UCB). ***Tulare Co.:*** Mineral King Rd E of Three Rivers, 36.47356°N 118.8465°W, 492 m, 24 May 2004, Schuh, Cassis, Schwartz, Weirauch, Wyniger, Forero, *Ceanothus cuneatus* (Hook.) Nutt. (Rhamnaceae), det. A. Sanders UCR 140578, 17♂ (AMNH_PBI 00096933–AMNH_PBI 00096949), 13♀ (AMNH_PBI 00096950–AMNH_PBI 00096962) (AMNH). **Oregon: *Jackson Co.:*** 10 mi E of Brownsboro, 42.46833°N 122.5129°W, 10 Jul 1979, R.T. and Joe Schuh, *Purshia tridentata* (Pursh.) DC (Rosaceae), 4♂ (AMNH_PBI 00062749–AMNH_PBI 00062752), 6♀ (AMNH_PBI 00062753–AMNH_PBI 00062757, AMNH_PBI 00063155) (AMNH). ***Klamath Co.:*** 13 mi W of Keno on Rt 66, 42.12667°N 122.18228°W, 1402 m, 29 Jul 1986, R.T. Schuh, *Amelanchier alnifolia* (Nutt.) Nutt. (Rosaceae), 3♂ (AMNH_PBI 00062758, AMNH_PBI 00062759, AMNH_PBI 00063257), 2♀ (AMNH_PBI 00062760, AMNH_PBI 00062761) (AMNH). 16 mi S of Beatty, 42.21014°N 121.26972°W, 26 Jul 1957, G.F. Kraft, *Cercocarpus ledifolius* Nutt. (Rosaceae), 1♂ (AMNH_PBI 00076191) (ORSU). 4 mi NW of Worden on road to Keno, 42.09003°N 121.90227°W, 17 Jul 1985, G.M. Stonedahl and J.D. McIver, *Amelanchier alnifolia* (Rosaceae), 4♂ (AMNH_PBI 00062762–AMNH_PBI 00062765), 2♀ (AMNH_PBI 00062766, AMNH_PBI 00062767) (AMNH).

Ceratopsallus plautus, new species
figures 2, 18; map 3

DIAGNOSIS: Recognized by the cream to pale greenish coloration, the brownish spots on the dorsum restricted to the hemelytra and of more or less uniform size and distribution (fig. 2), the relatively small size among *Ceratopsallus* spp., the average total length 2.74, and the structure of the male genitalia, the vesica being J-shaped and relatively short, the phallotheca (in common with *C. schwartzi* and *C. vauqueliniae*) bearing two spines, the one on the ventral surface slender, the other on the anterodorsal surface with a broad spoonlike apex, the left paramere distinctly flattened with the right-hand prong of the anterior process erect and weakly curving apically, the posterior process of the left paramere being very long, slender, and smoothly curving downward, and the right paramere with the apical processes being more or less equally developed (fig. 18). Most similar to *C. schwartzi* in the small size, lack of sexual dimorphism, and the form of the male genitalia, but easily distinguished by the slender apicodorsal spine on the phallotheca in *C. schwartzi*; distinguished from *C. vauqueliniae* by the strong sexual dimorphism in the eyes and antennae of that species.

DESCRIPTION: *Male:* Relatively small among *Ceratopsallus* spp., elongate ovoid, total length 2.56–2.87, length apex clypeus–cuneal fracture 1.75–1.90, width pronotum 0.77–0.81. COLORATION (fig. 2): Body and forewings faded green or pale; brownish spots on the dorsum restricted to the hemelytra and of more or less uniform size and distribution; coloration of appendages pale or greenish; membrane boldly marmorate, with a conspicuous and continuous dark area posterior to the cuneus; veins of membrane pale. SURFACE AND VESTITURE (figs. 2, 13C): As in generic description. STRUCTURE: Head: Eyes lacking sexual dimorphism, vertex relatively broad (fig. 2), eyes occupying approximately two-thirds height of head; antennal segment 2 weakly tapered proximally; labium reaching apex of hindtrochanters. GENITALIA (fig. 18): Vesica: Relatively short, J-shaped. Phallotheca: When viewed laterally with a weak triangular projection on the apicodorsal margin, a slender spine on the ventral margin, and a second spine on the anterodorsal margin with a broad, spoonlike apex. Parameres: Left paramere distinctly flattened with the right-hand prong of the anterior process erect and weakly curving apically, posterior process of left paramere very long, slender, broadly curving downward; right paramere with apical processes of about equal length.

Female: Elongate ovoid; total length 2.68–2.92, length apex clypeus–cuneal fracture 1.87–1.98, width pronotum 0.79–0.84. COLORATION (fig. 2): As in male. SURFACE AND VESTITURE: As in male. STRUCTURE: Hemelytra just covering abdomen; eyes usually similar in size to those of male (fig. 2); antennal segment 2 tapered toward base. GENITALIA (fig. 18): See generic description.

ETYMOLOGY: Named for the shape of the anterodorsal spine on the phallotheca. From the Latin, *plautus*, broad.

HOST: Recorded from *Arctostaphylos viscida* Parry and *Arctostaphylos* sp. (Ericaceae).

DISTRIBUTION (map 3): Known only from Wofford Heights, in the foothills of the Sierra Nevada Mountains, Kern County, California.

HOLOTYPE: **USA: California: *Kern Co.:*** 7 km W of Wofford Heights on Rt 155, 35.725°N 118.52555°W, 1520 m, 26 Jul 1999, Schwartz, Gillespie, Quiring, *Arctostaphylos* sp. (Ericaceae), 1♂ (AMNH_PBI 00071879) (CNC).

PARATYPES: **USA: California: *Kern Co.:*** 7 km W of Wofford Heights on Rt 155, 35.725°N 118.52555°W, 1520 m, 26 Jul 1999, Schwartz, Gillespie, Quiring, *Arctostaphylos* sp. (Ericaceae), 2♂ (AMNH_PBI 00071796, AMNH_PBI 00071803), 2♀ (AMNH_PBI 00071814, AMNH_PBI 00071819) (AMNH). *Arctostaphylos* sp. (Ericaceae), 12♂ (AMNH_PBI 00071793–AMNH_PBI 00071795, AMNH_PBI 00071797, AMNH_PBI 00071798, AMNH_PBI 00071800–AMNH_PBI 00071802, AMNH_PBI 00071804, AMNH_PBI 00071806, AMNH_PBI 00071913, AMNH_PBI 00071914), 14♀ (AMNH_PBI 00071807–AMNH_PBI 00071813, AMNH_PBI 00071815–AMNH_PBI 00071818, AMNH_PBI 00071880, AMNH_PBI 00071881, AMNH_PBI 00071884) (CNC). ***Tulare Co.:*** Mineral King Rd E of Three Rivers, 36.47356°N 118.8465°W, 492 m, 24 May 2004,

Fig. 18. *Ceratopsallus plautus:* Male genitalia (AMNH_PBI 00071806, vesica only; 00071801, other genitalic structures); female genitalia (AMNH_PBI 00071815).

Schuh, Cassis, Schwartz, Weirauch, Wyniger, Forero, *Arctostaphylos viscida* Parry (Ericaceae), det. Field ID, 62♂ (AMNH_PBI 00170512–AMNH_PBI 00170573), 11♀ (AMNH_PBI 00170574–AMNH_PBI 00170584) (AMNH).

Ceratopsallus quercicola, new species
figures 2, 19; map 4

DIAGNOSIS: Recognized by the cream to weakly orange coloration of the dorsum, the more or less uniform covering of orange-brown spots on the dorsum being restricted to the hemelytra (fig. 2), the small to moderate size among *Ceratopsallus* spp., average total length 2.89, and the structure of the male genitalia, the vesica being J-shaped and short (similar in form to *C. aquilonius* and *C. schwartzi*), the phallotheca when viewed laterally with a triangular projection on the apicodorsal margin and a single slender spine ventrally, the left paramere with the branches of the anterior process moderately long, smoothly curving, and forming a crescent, the posterior process relatively short, nearly straight in lateral view, and the right paramere with the apical processes asymmetrically developed, the left process distinctly longer than right (fig. 19). Similar in size and general appearance to *C. plautus* and *C. schwartzi*, although coloration in most specimens of *C. quercicola* with a stronger suggestion of orange (rather than green), and by the structure of the male genitalia, including the left paramere and the phallotheca, with one phallothecal spine in *C. quercicola*, rather than two as in the other two species.

DESCRIPTION: *Male:* Size moderate among *Ceratopsallus* spp., elongate ovoid, total length 2.83–2.97, length apex clypeus–cuneal fracture 1.88–2.02, width pronotum 0.86–0.93. COLORATION (fig. 2): Body and forewings faded green or pale; brownish spots on the dorsum of more or less uniform size and evenly distributed, either restricted to the hemelytra or covering entire dorsum; coloration of appendages pale or greenish; membrane boldly marmorate, with a weakly developed continuous dark area posterior to the cuneus; veins of membrane pale. SURFACE AND VESTITURE (figs. 2, 13C): As in generic description. STRUCTURE: Head: Eyes lacking sexual dimorphism, vertex relatively broad (fig. 2), eyes occupying approximately two-thirds height of head; antennal segment 2 weakly tapered proximally (fig. 2); labium reaching apex of hind trochanters. GENITALIA (fig. 19): Vesica: Relatively short, J-shaped. Phallotheca: When viewed laterally with a triangular projection on apicodorsal margin, apex flattened, a short, slender spine on ventral margin. Parameres: Left paramere with branches of anterior process smoothly curving, more or less lying in a single plane, posterior process relatively short, nearly straight in lateral view; right paramere with the apical processes unequally developed, the left process being distinctly longer than the right.

Female: Elongate ovoid; total length 2.64–2.87, length apex clypeus–cuneal fracture 1.79–1.98, width pronotum 0.87–1.08. COLORATION (fig. 2): As in male. SURFACE AND VESTITURE: As in male. STRUCTURE: Hemelytra extending just beyond apex of abdomen; eyes usually similar in size to those of male (fig. 2); antennal segment 2 tapered toward base. GENITALIA: Not examined.

ETYMOLOGY: Named for its habit of feeding on at least one species in the genus *Quercus* Linnaeus (Fagaceae), among other plant groups.

HOSTS: Recorded from *Arctostaphylos pungens* Kunth, *Arctostaphylos* sp. (Ericaceae), and *Quercus oblongifolia* Torr. (Fagaceae).

DISTRIBUTION (map 4): Known from moderate elevations in Riverside County, California, and from Cochise and Pima Counties in southern Arizona.

HOLOTYPE: **USA: Arizona: *Pima Co.:*** 7.5 mi S of Coronado Natl. Forest boundary on Mount Lemmon Rd [32.31°N 110.72°W], 1433 m, 11 Jun 1983, Schuh, Schwartz, and Stonedahl, mercury vapor light, 1♂ (AMNH_PBI 00063251) (AMNH).

PARATYPES: **USA: Arizona: *Cochise Co.:*** 2.9 mi on Rt 92, Carr Canyon, Huachuca Mountains, 31.45382°N 110.25813°W, 3 Jun 1997, T.J. Henry and A.G Wheeler, Jr., *Arctostaphylos pungens* (Ericaceae), 5♂ (AMNH_PBI 00068462–AMNH_PBI 00068466) (USNM). Ash Canyon Road, 0.5 mi W of Hwy 92, 31.38194°N 110.22444°W, 1554 m, 31 May 1993, N. McFarland, 3♂ (AMNH_PBI 00068467–AMNH_PBI

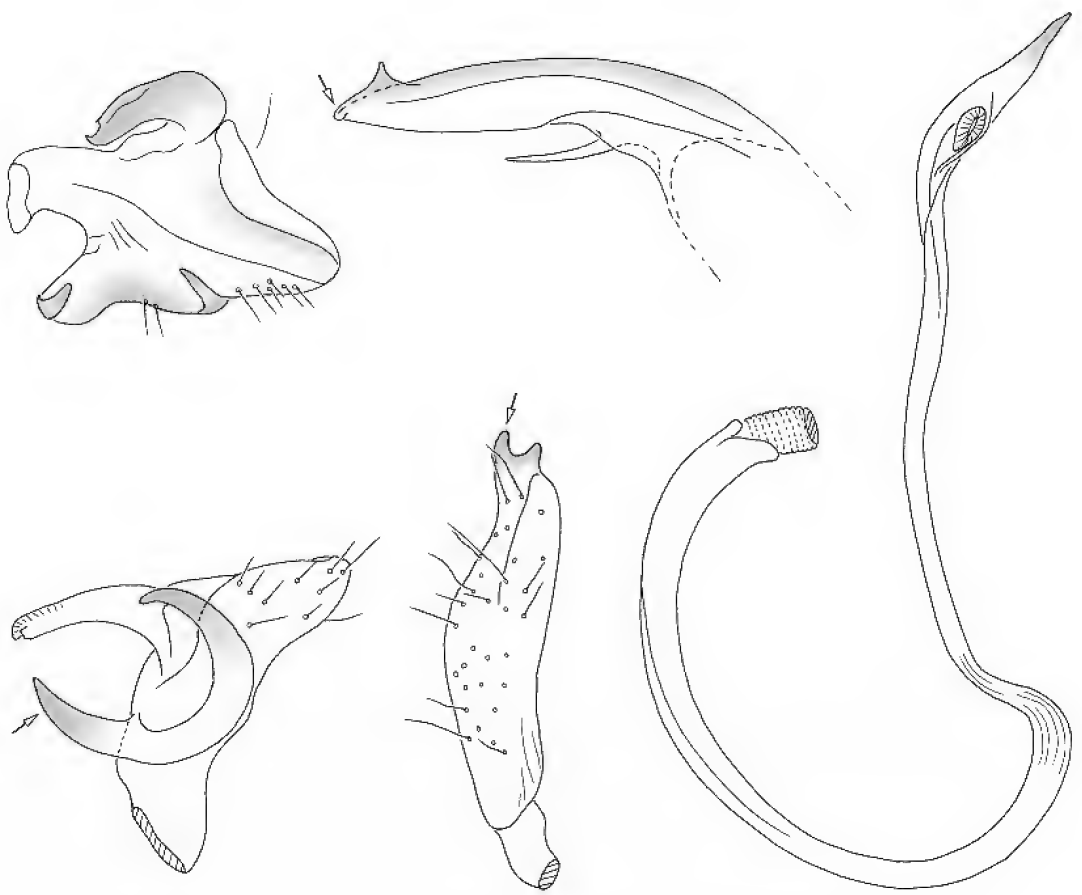


Fig. 19. *Ceratopsallus quercicola:* Male genitalia (AMNH_PBI 00068477).

00068469) (USNM); 4 Jun 1997, T.J. Henry and A.G Wheeler, Jr., *Arctostaphylos* sp. (Ericaceae), 2♂ (AMNH_PBI 00068470, AMNH_PBI 00068471) (USNM); 11 Jun 1997, T.J. Henry and A.G. Wheeler, Jr., 1♂ (AMNH_PBI 00068474) (USNM); 2 Jun 1997, T.J. Henry and A.G. Wheeler, Jr, 2♂ (AMNH_PBI 00068476, AMNH_PBI 00068477) (USNM). Huachuca Mountains, Carr Canyon, 31.45667°N 110.23889°W, 3 Jun 1997, T.J. Henry and A.G Wheeler, Jr., *Arctostaphylos pungens* (Ericaceae), 7♂ (AMNH_PBI 00063250, AMNH_PBI 00068459–AMNH_PBI 00068461, AMNH_PBI 00068472, AMNH_PBI 00068473, AMNH_PBI 00068475) (USNM). ***Pima Co.:*** 7.5 mi S of Coronado Natl. Forest boundary on Mount Lemmon Rd, 32.31°N 110.72°W, 1433 m, 11 Jun 1983, Schuh, Schwartz, and Stonedahl, *Quercus oblongifolia* (Fagaceae), 39♂ (AMNH_PBI 00063246–AMNH_PBI 00063249, AMNH_PBI 00063335–AMNH_PBI 00063347, AMNH_PBI 00063354–AMNH_PBI 00063375), 34♀ (AMNH_PBI 00062739–AMNH_PBI 00062748, AMNH_PBI 00063252–AMNH_PBI 00063256, AMNH_PBI 00063348–AMNH_PBI 00063353, AMNH_PBI 00063376–AMNH_PBI 00063388) (AMNH). **California:** ***Riverside Co.:*** San Jacinto Mountains, Pinon Flat, 33.81444°N 116.67833°W, 28 May 1940, C.D. Michener, *Arctostaphylos* sp. (Ericaceae), 2♂ (AMNH_PBI 00079772, AMNH_PBI 00079773) (UCB).

Ceratopsallus ribesi (Knight), new combination
figures 2, 20; map 4

Phymatopsallus ribesi Knight, 1968: 50 (n.sp.).

DIAGNOSIS: Recognized by the weakly orange coloration, the orange dots scattered

over the entire dorsum (fig. 2), the moderate size among *Ceratopsallus* spp., average total length 2.99, and the form of the male genitalia, the vesica forming an elongate J, the phallotheca with a truncate apex, the left paramere with the right-hand prong of the anterior process recurved, and the right paramere with the apical processes unequally developed, the left being distinctly longer than the right (fig. 20). Similar to *C. croceus* and *C. pantherinus* in the orangish coloration with orange spotting, but somewhat smaller than those species and lacking the distinct sexual dimorphism in the eyes and antennae.

REDESCRIPTION: *Male:* Size moderate among *Ceratopsallus* spp., elongate, nearly parallel-sided, total length 3.07–3.14, length apex clypeus–cuneal fracture 2.03–2.09, width pronotum 0.98–1.04. COLORATION (fig. 2): Body and forewings weakly orange; entire dorsum with moderately dense covering of orange to weakly brown spots; eyes silvery to reddish; coloration of appendages pale or weakly orange; membrane boldly marmorate, with a large dark area posterior to the cuneus; veins of membrane pale. SURFACE AND VESTITURE (figs. 2, 13C): As in generic description. STRUCTURE: Head: Eyes not sexually dimorphic, large, vertex relatively broad (fig. 2), eyes occupying about two-thirds height of head; antennal segment 2 weakly tapered proximally (fig. 2); labium reaching to apex of hind trochanters. GENITALIA (figs. 20): Vesica: More or less J-shaped. Phallotheca: When viewed laterally with a broadly flattened apex, and a slender spine on ventral margin. Parameres: Left paramere with right-hand prong of anterior process more or less erect, sinuously curving, left-hand prong smoothly curving, posterior process of paramere relatively long, more or less straight in lateral view; right paramere long and broad, apical processes asymmetrically developed, left process longer and more slender than right.

Female: Elongate ovoid; total length 2.73–2.81, length apex clypeus–cuneal fracture 1.84–1.85, width pronotum 0.93–0.97. COLORATION (fig. 2): As in male. SURFACE AND VESTITURE: As in male. STRUCTURE: Hemelytra extending just beyond apex of abdomen; eyes similar in size to those of male, vertex relatively broad (fig. 2); antennal segment 2 tapered toward base. GENITALIA: Not examined.

HOST: Recorded as feeding on *Ribes* sp. (Grossulariaceae) (Knight, 1968).

DISTRIBUTION (map 4): Known only from Nye county, southern Nevada.

HOLOTYPE: **USA: Nevada:** ***Nye Co.:*** Mercury, 12M (W) [36.66056°N 115.99361°W], 11 Aug 1965–13 Aug 1965, J. Merino, 1♂ (AMNH_PBI 00069802) (USNM).

PARATYPES: **USA: Nevada:** ***Nye Co.:*** Mercury, 12M (W), 36.66056°N 115.99361°W, 11 Aug 1965–13 Aug 1965, J. Merino, *Ribes* sp. (Grossulariaceae), 7♂ (AMNH_PBI 00068478–AMNH_PBI 00068480, AMNH_PBI 00068633, AMNH_PBI 00068634, AMNH_PBI 00071876, AMNH_PBI 00071877), 6♀ (AMNH_PBI 00068481–AMNH_PBI 00068484, AMNH_PBI 00068635, AMNH_PBI 00068636) (USNM).

Ceratopsallus schwartzi, new species
figures 2, 21; map 4

DIAGNOSIS: Recognized by the cream to pale greenish coloration, the brownish spots on the dorsum restricted to the hemelytra and forming a somewhat blotchy pattern (fig. 2), the relatively small size among *Ceratopsallus* spp., the average total length 2.49, and the structure of the male genitalia, the vesica being J-shaped and relatively short, the phallotheca (in common with *C. plautus* and *C. vauqueliniae*) bearing two spines, the one on the ventral surface slender, the other on the anterodorsal surface being weakly flattened and minutely serrate on the apical region, the left paramere with the spines of the anterior process smoothly curving and forming a crescent shape, the posterior process of the left paramere being long, slender, and smoothly curving, and the right paramere with the apical processes being unequally developed, the left process somewhat longer and broader than the right (fig. 21). Most similar to *C. plautus* in the small size, lack of sexual dimorphism, and the form of the male genitalia, but easily distinguished by the apically broad apicodorsal spine on the phallotheca in *C. plautus*; distinguished from *C. vauqueliniae*, which also bears two spines on the phallotheca, by the strong sexual dimorphism in the eyes and antennae of that species.

Fig. 20. *Ceratopsallus ribesi:* Male genitalia (AMNH_PBI 00068634).

DESCRIPTION: *Male:* Relatively small among *Ceratopsallus* spp., elongate ovoid, total length 2.41–2.57, length apex clypeus–cuneal fracture 1.66–1.72, width pronotum 0.65–0.72. COLORATION (fig. 2): Body and forewings faded green or pale; brownish spots on the dorsum restricted to the hemelytra and forming a somewhat blotchy

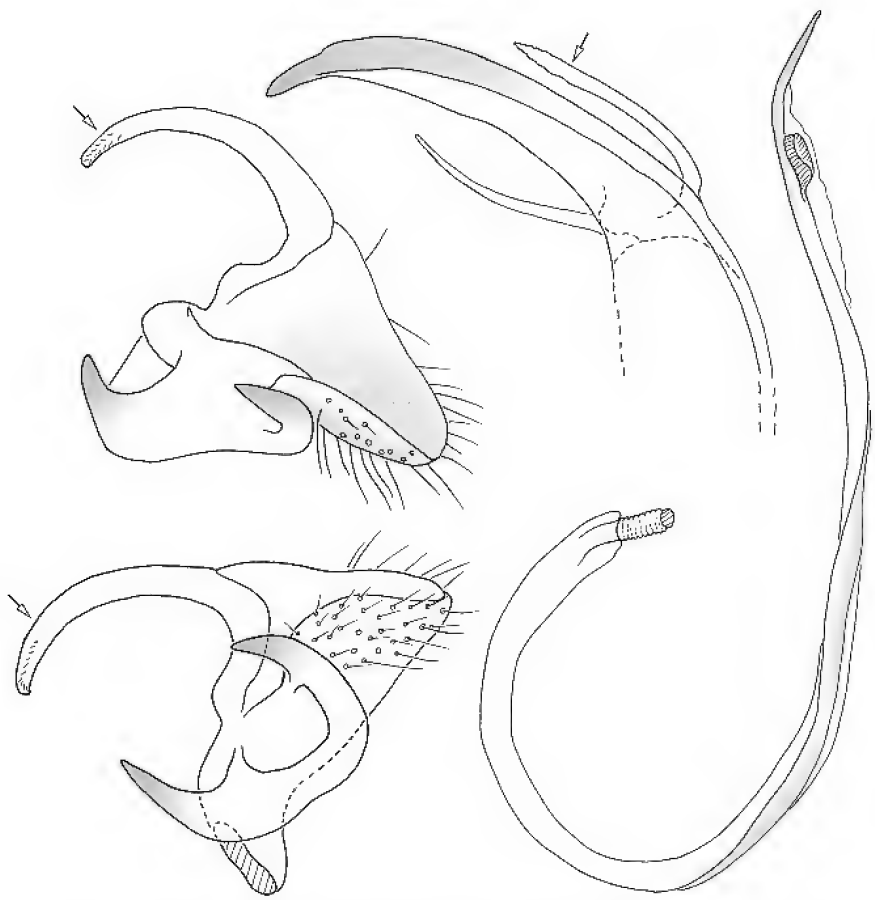


Fig. 21. *Ceratopsallus schwartzi:* Male genitalia (AMNH_PBI 00071780).

pattern; coloration of appendages pale or greenish; membrane boldly marmorate, with a conspicuous and continuous dark area posterior to the cuneus; veins of membrane pale. SURFACE AND VESTITURE (figs. 2, 13C): As in generic description. STRUCTURE: Head: Eyes lacking sexual dimorphism, vertex relatively broad (fig. 2), eyes occupying approximately two-thirds height of head; antennal segment 2 weakly tapered proximally; labium reaching apex of hind trochanters. GENITALIA (figs. 21): Vesica: Relatively short, J-shaped. Phallotheca: When viewed laterally without ornamentation on apicodorsal margin, a slender spine on ventral margin, and a second spine on the anterodorsal margin with a weakly flattened and minutely serrate apical region. Parameres: Left paramere with branches of anterior process relatively short, posterior process long, slender, broadly curving downward; right paramere with the apical processes being unequally developed, the left process somewhat longer and broader than the right.

Female: Elongate ovoid; total length 2.39–2.84, length apex clypeus–cuneal fracture 1.68–1.98, width pronotum 0.71–0.86. COLORATION (fig. 2): As in male. SURFACE AND VESTITURE: As in male. STRUCTURE: Hemelytra extending just beyond apex of abdomen; eyes usually similar in size to those of male (fig. 2); antennal segment 2 tapered toward base. GENITALIA: Not examined.

ETYMOLOGY: Named for the collector of most known specimens, Michael D. Schwartz.

HOSTS: Recorded only from *Arctostaphylos* sp. (Ericaceae).

DISTRIBUTION (map 4): Known from Fresno and Kern Counties in the foothills of the Sierra Nevada Mountains, and from Marin County, California.

HOLOTYPE: **USA: California:** ***Fresno Co.:*** 1 km W of Tollhouse on Tollhouse Rd, 37.01038°N 119.40385°W, 600 m, 25 Jul 1999, M.D. Schwartz, *Arctostaphylos* sp. (Ericaceae), 1♂ (AMNH_PBI 00071915) (CNC).

PARATYPES: **USA: California:** ***Fresno Co.:*** 1 km W of Tollhouse on Tollhouse Rd, 37.01038°N 119.40385°W, 600 m, 25 Jul 1999, M.D. Schwartz, *Arctostaphylos* sp. (Ericaceae), 3♂ (AMNH_PBI 00071775, AMNH_PBI 00071777, AMNH_PBI 00071780), 2♀ (AMNH_PBI 00071785, AMNH_PBI 00071883) (AMNH). 5♂ (AMNH_PBI 00071776, AMNH_PBI 00071778, AMNH_PBI 00071779, AMNH_PBI 00071882, AMNH_PBI 00071916), 4♀ (AMNH_PBI 00071784, AMNH_PBI 00071786–AMNH_PBI 00071788) (CNC). ***Kern Co.:*** Cedar Creek Campground on Rt 115, 35.73726°N 118.61183°W, 1500 m, 26 Jun 1999, M.D. Schwartz, *Arctostaphylos* sp. (Ericaceae), 1♀ (AMNH_PBI 00071789) (AMNH). *Arctostaphylos* sp. (Ericaceae), 4♂ (AMNH_PBI 00071781–AMNH_PBI 00071783, AMNH_PBI 00071799), 3♀ (AMNH_PBI 00071790–AMNH_PBI 00071792) (CNC). ***Marin Co.:*** Mount Tamalpais State Park, 37.90389°N 122.595°W, 01 Aug 1916, W.M. Giffard, 1♂ (AMNH_PBI 00077822) (CAS).

Ceratopsallus septentrionalis, new species
figures 2, 22; map 4

DIAGNOSIS: Recognized by the cream to pale greenish coloration, the more or less uniform covering of brownish spots on the dorsum being restricted to the hemelytra (fig. 2), the moderate size among *Ceratopsallus* spp., the average total length 2.97, and the structure of the male genitalia, with the vesica being long and almost filamentous and forming a single coil, the phallotheca with a single, short, slender spine on the ventral surface and a broad apex with a straight edge, the left paramere with the right-hand prong of the anterior process flattened, relatively broad, and curving toward the rear of the paramere body, the posterior process of the left paramere long, slender, and nearly straight with a distinct apical "hook", in combination with the right paramere with unequally developed apical processes, the left process being distinctly longer than the right (fig. 22). Most similar to *C. plautus* and *C. schwartzi* in the relatively small size, coloration, and lack of sexual dimorphism, but easily distinguished by the single spine on the phallotheca in *C. septentrionalis*, by the longer vesica, and by the structure of the left paramere with the long straight posterior process with a distinct hook at the apex.

DESCRIPTION: *Male:* Size moderate among *Ceratopsallus* spp., elongate ovoid, total length 2.88–3.10, length apex clypeus–cuneal fracture 1.98–2.15, width pronotum 0.84–0.97. COLORATION (fig. 2): Body and forewings faded green or pale; brownish spots on the dorsum restricted to the hemelytra, of more or less uniform size and evenly distributed; coloration of appendages pale or greenish; membrane boldly marmorate, with a conspicuous and continuous dark area posterior to the cuneus; veins of membrane pale. SURFACE AND VESTITURE (figs. 2, 13C): As in generic description. STRUCTURE: Head: Eyes lacking sexual dimorphism, vertex relatively broad (fig. 2), eyes occupying approximately two-thirds height of head; antennal segment 2 weakly tapered proximally (fig. 2); labium long, reaching a short distance beyond hind trochanters. GENITALIA (fig. 22): Vesica: Relatively long, slender, forming a complete coil. Phallotheca: With a broad truncate apex, when viewed laterally usually with a triangular projection on apicodorsal margin, a short, slender spine on ventral margin. Parameres: Left paramere with prongs of anterior process relatively broad, right-hand prong strongly curving and pointed in same direction as posterior process of paramere, posterior process long, slender, nearly straight, with a distinct hook at apex; right paramere with the apical processes unequally developed, the left process being somewhat longer and more slender than the right.

Female: Elongate ovoid; total length 2.70–3.13, length apex clypeus–cuneal fracture 1.83–2.09, width pronotum 0.85–0.93. COLORATION (fig. 2): As in male. SURFACE

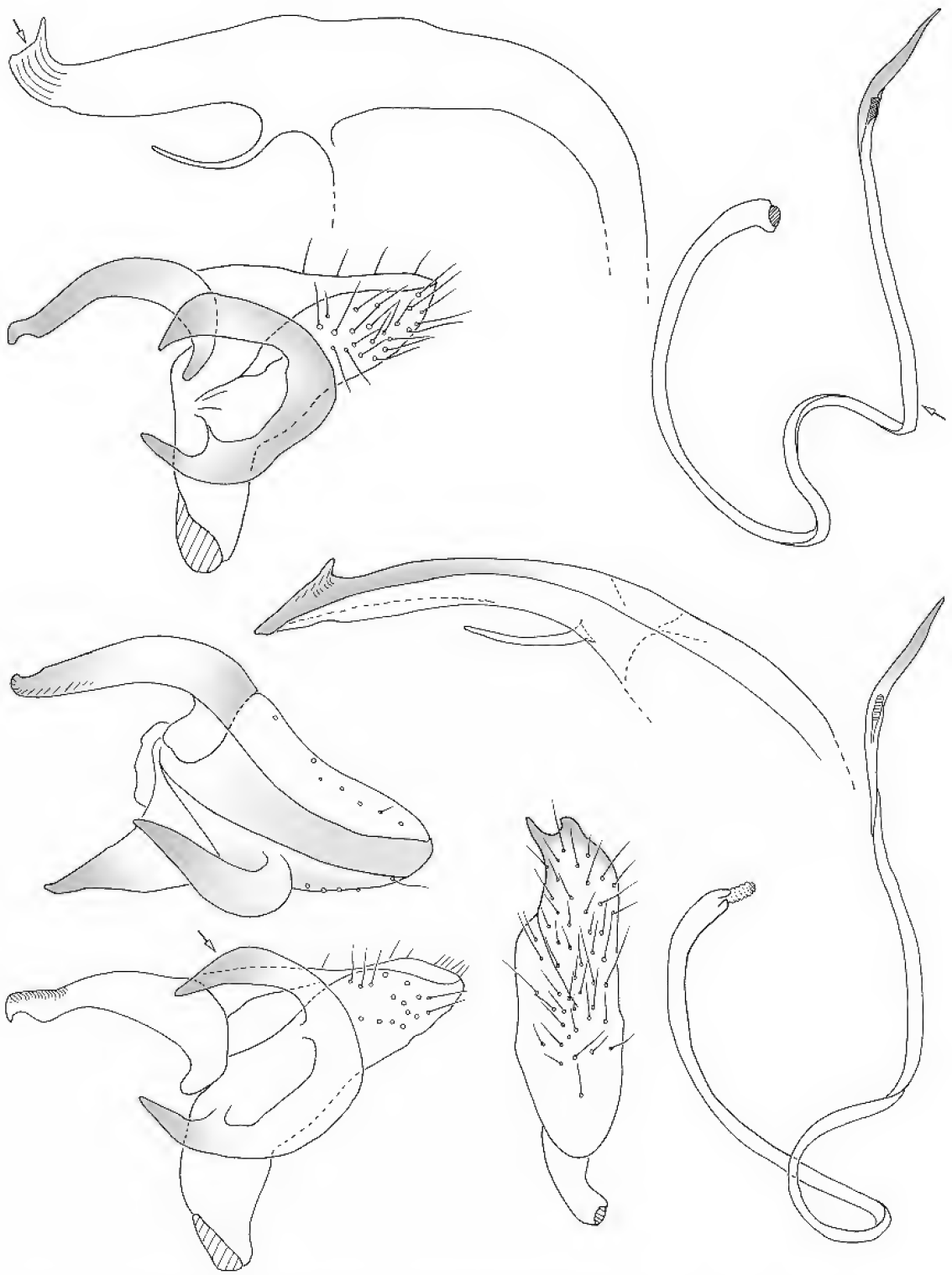


Fig. 22. *Ceratopsallus septentrionalis:* Male genitalia (upper, AMNH_PBI 00062810; lower, AMNH_PBI 00077235; vesicae drawn at 50% of scale of other structures).

AND VESTITURE: As in male. STRUCTURE: Hemelytra extending just beyond apex of abdomen; eyes usually similar in size to those of male (fig. 2); antennal segment 2 tapered toward base. GENITALIA: Not examined.

ETYMOLOGY: Named for its distribution; from the Latin, *septentrionalis*, northern.

HOST: Recorded from *Arctostaphylos canescens* Eastw. and *Arctostaphylos* sp. (Ericaceae).

DISTRIBUTION (map 4): Known from Josephine County, in southern Oregon, south to Lake and Trinity Counties in the coastal mountain ranges of northern California.

HOLOTYPE: **USA: California: *Lake Co.:*** 22 mi E of Lucerne on Rt 20 [39.0099°N 122.43153°W], 335 m, 25 Jul 1986, R.T. Schuh, *Arctostaphylos* sp. (Ericaceae), 1♂ (AMNH_PBI 00063262) (AMNH).

PARATYPES: **USA: California: *Lake Co.:*** 22 mi E of Lucerne on Rt 20, 39.0099°N 122.43153°W, 335 m, 25 Jul 1986, R.T. Schuh, *Arctostaphylos* sp. (Ericaceae), 2♂ (AMNH_PBI 00062817, AMNH_PBI 00062818), 7♀ (AMNH_PBI 00062819–AMNH_PBI 00062823, AMNH_PBI 00063265, AMNH_PBI 00063266) (AMNH). ***Siskiyou Co.:*** S boundary Lava Beds National Monument on Medicine Lk. Road, 41.75333°N 121.50556°W, 17 Jul 1985, G.M. Stonedahl and J.D. McIver, *Arctostaphylos* sp. (Ericaceae), 20♂ (AMNH_PBI 00062788–AMNH_PBI 00062805, AMNH_PBI 00063259, AMNH_PBI 00063260), 4♀ (AMNH_PBI 00062806–AMNH_PBI 00062808, AMNH_PBI 00063263) (AMNH). ***Trinity Co.:*** Van Duzen Road, 40.59833°N 124.15611°W, 5 Aug 1951, Bliven, 1♂ (AMNH_PBI 00077825), 1♀ (AMNH_PBI 00077826) (AMNH); 30 Jul 1950–15 Aug 1951, B.P. Bliven, 9♂ (AMNH_PBI 00077234–AMNH_PBI 00077236, AMNH_PBI 00077253–AMNH_PBI 00077256, AMNH_PBI 00077258, AMNH_PBI 00077259), 19♀ (AMNH_PBI 00077221–AMNH_PBI 00077230, AMNH_PBI 00077238–AMNH_PBI 00077246) (CAS). **Oregon: *Josephine Co.:*** 7 mi S of Cave Junction, 42.06164°N 123.64694°W, 400 m, 10 Jul 1979, R.T. and Joe Schuh, *Arctostaphylos canescens* (Ericaceae), 3♂ (AMNH_PBI 00062814–AMNH_PBI 00062816) (AMNH). Rough and Ready Wayside, S of Cave Junction, 42.16306°N 123.64694°W, 400 m, 10 Jul 1979, R.T. and Joe Schuh, *Arctostaphylos canescens* (Ericaceae), 4♂ (AMNH_PBI 00062809–AMNH_PBI 00062811, AMNH_PBI 00063261), 3♀ (AMNH_PBI 00062812, AMNH_PBI 00062813, AMNH_PBI 00063264) (AMNH).

Ceratopsallus vauqueliniae, new species
figures 2, 23; map 4

DIAGNOSIS: Recognized by the creamy coloration, the more or less uniform covering of brownish spots on the dorsum being restricted to the hemelytra, the strong sexual dimorphism in the eyes and antennae of the males (fig. 2), the relatively small size among *Ceratopsallus* spp., the average total length 2.54, and the structure of the male genitalia, the vesica being J-shaped and short, the phallotheca bearing two spines (in common with *C. plautus* and *C. schwartzi*) the one on the ventral surface being slender, the other on the posteroventral surface being apically flattened and truncate, the left paramere with a short body, the posterior process of the left paramere also being short, and the right paramere with the apical processes short and equally developed (fig. 23). Similar to *C. plautus* and *C. schwartzi* by virtue of having two spines on the phallotheca, but *C. vauqueliniae* unique in having both spines on the ventral surface. Similar to *C. croceus* and *C. pantherinus* by the presence of distinct sexual dimorphism, the males having large eyes and antennal segment 2 of relatively large and uniform diameter, but both *C. croceus* and *C. pantherinus* much larger than *C. vauqueliniae* and with reddish spots on the dorsum, rather than brown spots.

DESCRIPTION: *Male:* Relatively small among *Ceratopsallus* spp., broadly ovoid, total length 2.52–2.61, length apex clypeus–cuneal fracture 1.79–1.89, width pronotum 0.89–0.96. COLORATION (fig. 2): Body and forewings pale; brownish spots on the dorsum restricted to the hemelytra, of more or less uniform size and evenly distributed; coloration of appendages pale; membrane boldly marmorate, without a conspicuous and continuous dark area posterior to the cuneus; veins of membrane pale. SURFACE AND VESTITURE (figs. 2, 13C): As in generic description. STRUCTURE: Head: Eyes showing strong sexual dimorphism, vertex relatively narrow (fig. 2), eyes occupying almost entire height of head; antennal segment 2 cylindrical, of uniform diameter

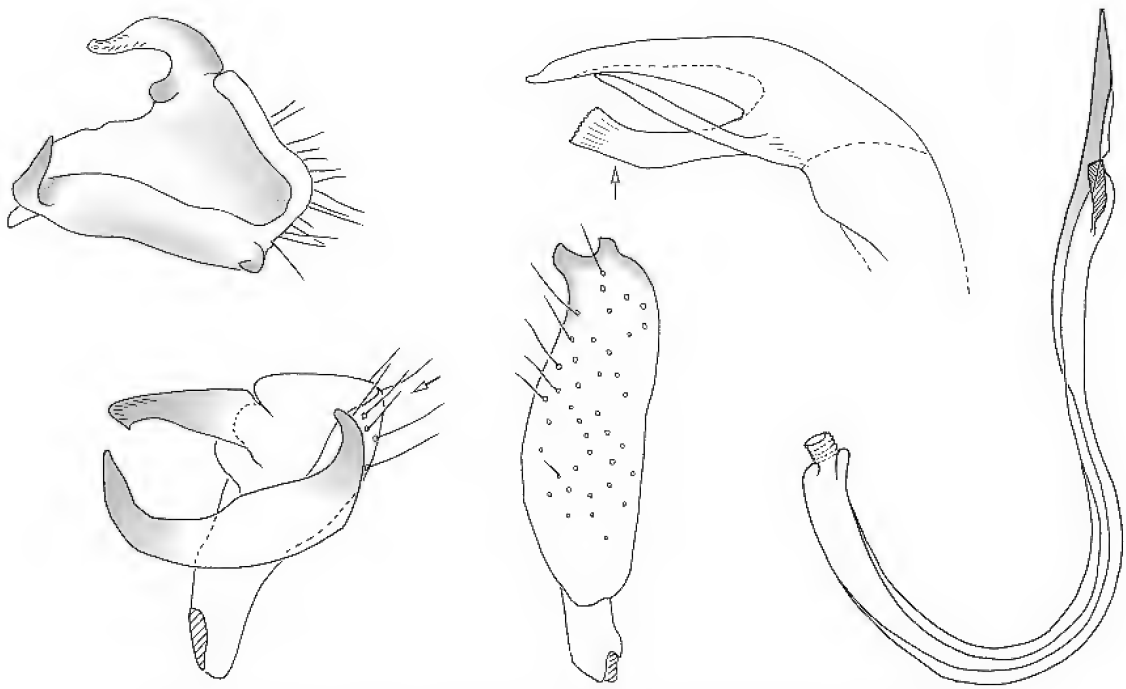


Fig. 23. *Ceratopsallus vauqueliniae:* Male genitalia (AMNH_PBI 00063230).

over entire length; labium reaching apex of hind trochanters. GENITALIA (figs. 23): Vesica: Short, J-shaped. Phallotheca: When viewed laterally without ornamentation on apicodorsal margin, a slender spine on ventral margin, and a second rather broadly flattened spine with a truncate apex on the posteroventral margin. Parameres: Left paramere with very short body, prongs of anterior process broadly separated, relatively short, posterior process short, nearly straight in lateral view; right paramere with the apical processes of about equal length.

Female: Elongate ovoid; total length 2.54–2.76, length apex clypeus–cuneal fracture 1.82–1.94, width pronotum 0.88–0.97. COLORATION (fig. 2): As in male. SURFACE AND VESTITURE: As in male. STRUCTURE: Hemelytra extending just beyond apex of abdomen; eyes smaller than those of male; vertex relatively broad (fig. 2); antennal segment 2 tapered toward base. GENITALIA: Not examined.

ETYMOLOGY: Named for the host, *Vauquelinia californica* (Torr.) Sarg. (Rosaceae).

HOST: Recorded only from *Vauquelinia californica* (Rosaceae).

DISTRIBUTION (map 4): Known only from the type locality in Pima County, southern Arizona.

HOLOTYPE: **USA: Arizona: *Pima Co.:*** 4 mi N of Coronado Natl. Forest boundary on Mount Lemmon Rd [32.36°N 110.7°W], 1219 m, 11 Jun 1983, Schuh, Schwartz, and Stonedahl, *Vauquelinia californica* (Torr.) Sarg. (Rosaceae), 1♂ (AMNH_PBI 00063232) (AMNH).

PARATYPES: **USA: Arizona: *Pima Co.:*** 4 mi N of Coronado Natl. Forest boundary on Mount Lemmon Rd, 32.36°N 110.7°W, 1219 m, 11 Jun 1983, Schuh, Schwartz, and Stonedahl, *Vauquelinia californica* (Rosaceae), 3♂ (AMNH_PBI 00063229–AMNH_PBI 00063231), 5♀ (AMNH_PBI 00063233–AMNH_PBI 00063237) (AMNH).

Cercocarpopsallus, new genus

Type species: *Cercocarpopsallus bispinosus*, new species.

DIAGNOSIS: Recognized by the pale greenish background coloration of the dorsum with numerous greenish to brown spots

on the hemelytra (figs. 2, 3), in combination with the small field of short spinelike setae on the left side just anterior to the opening of the pygophore (fig. 24D, F). Most similar to *Bisulcopsallus* spp. and many of *Ceratopsallus* spp. in general appearance and in lacking sexually dimorphic eyes; distinguished by the absence of a conspicuously elevated tubercle on the pygophore.

DESCRIPTION: *Male:* Size moderate to relatively large among *Phymatopsallus*-group taxa, nearly parallel-sided, total length 2.86–3.40, length apex clypeus–cuneal fracture 1.92–2.55, width pronotum 0.92–1.04. COLORATION (figs. 2, 3): Body and forewings faded green, corium, clavus, cuneus with heavy spotting of green to brown; eyes pale to reddish; coloration of appendages pale, greenish, femora with scattered, weak, brown spots; tibial spines dark with dark bases; membrane weakly marmorate, with conspicuous large dark areas; veins of membrane pale. SURFACE AND VESTITURE (figs. 2, 3, 24C): Dorsal body surface smooth, impunctate, weakly shining. Dorsal vestiture of recumbent, simple setae intermixed with sericeous silvery setae; pygophore with small field of short spinelike setae on a very weakly elevated tubercle on the left side just anterior to the opening (fig. 24D, F). STRUCTURE: Head: Weakly transverse, posterior margin of eyes contiguous with anterior margin of pronotum, frons weakly protruding beyond anterior margin of eyes; posterior margin of vertex indistinct; eyes relatively small and widely separated (figs. 2, 3, 24); antennae inserted above ventral margin of eye by roughly diameter of segment 1, insertion contiguous with eye (fig. 24A); antennal segment 2 very weakly tapered proximally (figs. 2, 3); labium reaching to or slightly surpassing hind margin of hind trochanters. Thorax: Mesothoracic spiracle and metathoracic scent-efferent system as in figure 24B. *Legs:* Claws strongly bent preapically, pulvilli flaplike, parempodia setiform (fig. 24E). Abdomen: Tapered posteriorly. GENITALIA (figs. 24F, 25, 26): Pygophore: Of moderate size, conical in shape (fig. 24F). Vesica: Formed of a single strap, varying from moderately long and slender to much shorter and robust, with two apical spines of varying conformation; secondary gonopore moderately to strongly developed, without a well-developed gonopore sclerite. Phallotheca: With apical portion weakly elongate, tapered, dorsal margin near apex with a triangular fold. Parameres: Left paramere with anterior process moderately to very strongly developed, posterior process relatively short, truncate, as in many other Phylinae; right paramere relatively large, elongate, nearly parallel-sided, apex with a distinct process on either side.

Female: Elongate ovoid; total length 2.75–3.32, length apex clypeus–cuneal fracture 1.95–2.31, width pronotum 0.90–1.01. COLORATION (fig. 2): As in male. SURFACE AND VESTITURE: As in male. STRUCTURE: Hemelytra slightly surpassing apex of abdomen; eyes usually similar in size to those of male; antennal segment 2 tapered toward base (figs. 2, 3). GENITALIA (fig. 25): Sclerotized rings triangular, lying in a more or less vertical plane; vestibulum leading from base of ovipositor valves to anterior margin of bursa copulatrix via an elongate tubular sclerite open on one side; bursa copulatrix positioned distinctly posterior to base of ovipositor valves, posterior margin of bursa bearing a distinct, but isolated, sclerite; structure of posterior wall not clearly discernable in all preparations.

ETYMOLOGY: Named for its occurrence on the genus *Cercocarpus* (Rosaceae) in combination with the generic name *Psallus*. Gender masculine.

HOSTS: *Cercocarpus* spp. (Rosaceae).

DISCUSSION: The two species presently placed in this genus are united by the presence of a small field of short spinelike setae on the left side of the pygophore, these being located on a very low tubercle. The phallotheca and right paramere are very similar in structure, as are the female genitalia in both known species. In the latter case, the removal of the bursa copulatrix from the base of the ovipositor valve, the distinctive long connecting sclerite of the vestibulum, and the sclerite embedded in the posterior wall of the bursa copulatrix would appear to be diagnostic for the group. The left paramere and the vesica are strongly dissimilar in structure in the two known species. *Cercocarpopsallus* spp. also lack spine(s) on the phallotheca, in contrast to

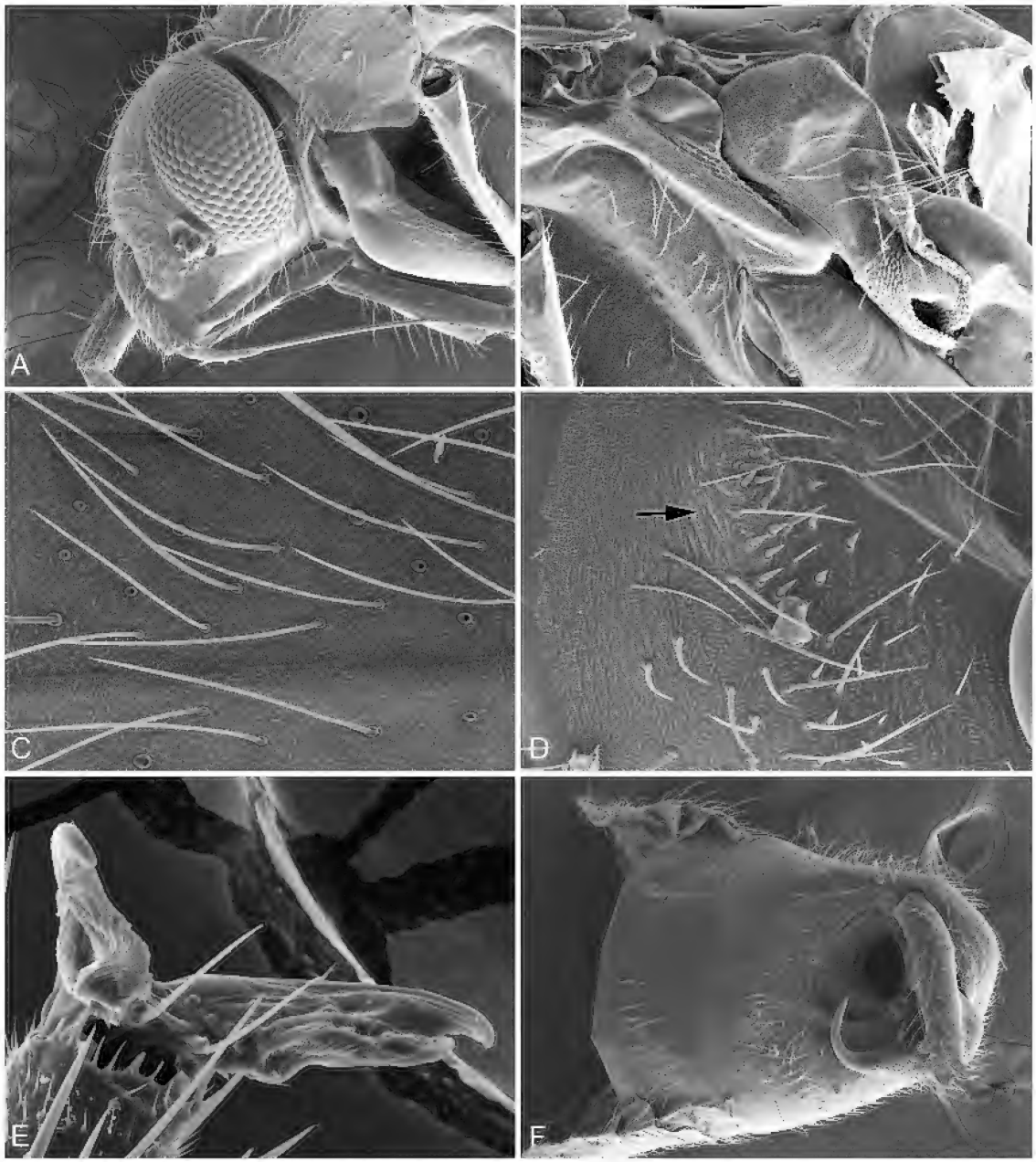
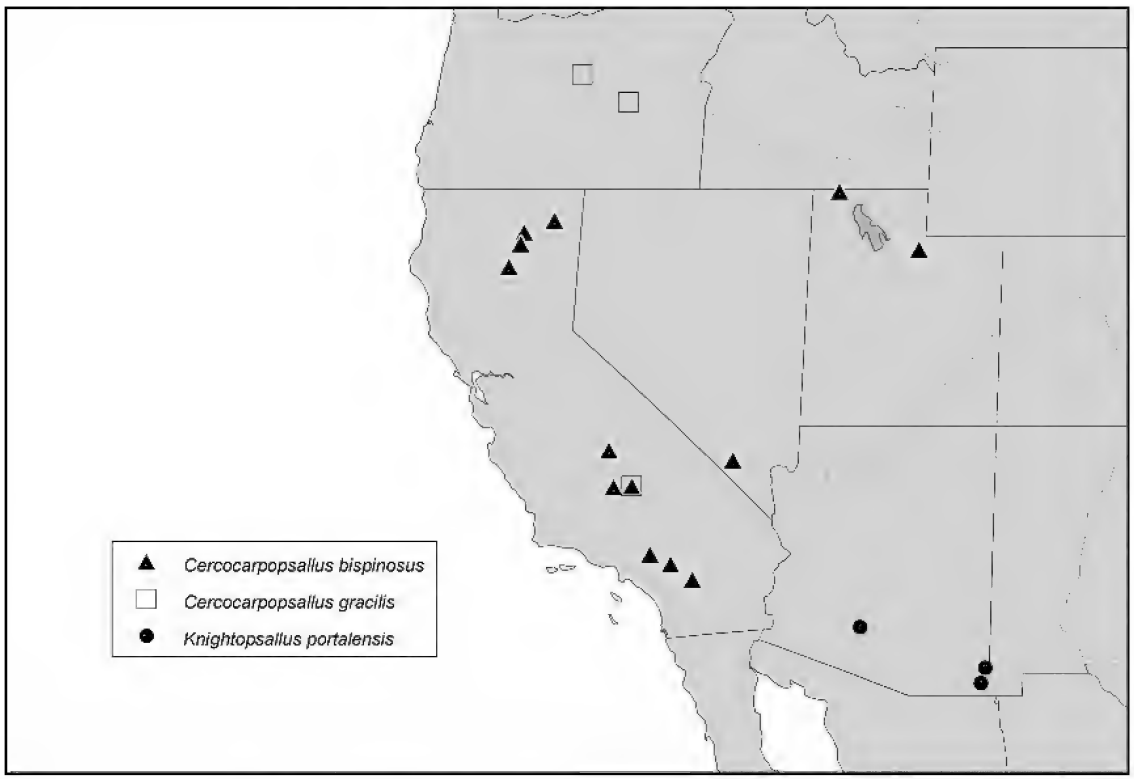


Fig. 24. *Cercocarpopsallus bispinosus*. **A.** Lateral view of head. **B.** Mesothoracic spiracle and metathoracic scent-efferent system. **C.** Setae on hemelytron. **D.** Detail of patch of specialized setae on left side of male pygophore (arrow indicates low tubercle and setal patch on pygophore). **E.** Frontoventral view of pretarsus. **F.** Dorsal view of male pygophore.

most other members of the *Phymatopsallus* group.

Although the Miridae fauna associated with *Cercocarpus* spp. (Rosaceae) is becoming better understood (Knight, 1968; Schuh, 2000b, 2004a; Stonedahl, 1988), and in some groups—such as *Oligotylus*—is known from a very large number of specimens, the amount of material available for *Cercocarpopsallus* is limited. The reason appears to be



Map 5. Distribution of *Cercocarpopsallus* and *Knightopsallus* spp.

that the bugs appear later in the year than do most other *Cercocarpus* feeding species and have therefore not been frequently collected during much of our field effort, which has focused on the preponderance of taxa that emerge during springtime when the plants are in full flower.

Cercocarpopsallus bispinosus, new species
figures 2, 24, 25; map 5

DIAGNOSIS: Recognized, in conjunction with the green spotting on the hemelytra (fig. 2) and the field of spicules on the left side of the pygophore (fig. 24D), by the very long, heavy, and curving anterior process of the left paramere and the heavy-bodied vesica with its large gonopore and one broad apically directed spine and another elongate retrorse spine (fig. 25).

DESCRIPTION: *Male:* Size moderate among *Phymatopsallus*-group taxa, elongate, nearly parallel-sided, total length 2.86–3.40, length apex clypeus–cuneal fracture 1.92–2.55, width pronotum 1.00–1.04. COLORATION (fig. 2): Pale, faded greenish, with moderately dense covering of brown spots on clavus, corium, and cuneus; membrane boldly marmorate with broad dark areas over much of membrane, veins pale to infuscate. SURFACE AND VESTITURE (figs. 2, 24C): As in generic description. STRUCTURE: Head: Labium reaching or slightly surpassing hind margin of hind trochanters. GENITALIA (fig. 25): Vesica: Heavy-bodied with large gonopore and one broad, apically directed spine and another elongate retrorse spine. Parameres: Left paramere with anterior process very long, heavy, and curving, posterior process slender, with truncate apex.

Female: Elongate ovoid; total length 2.88–3.32, length apex clypeus–cuneal fracture 1.95–2.31, width pronotum 0.90–1.01. COLORATION (fig. 2): As in male. SURFACE AND VESTITURE: As in male. STRUCTURE: Similar to male. GENITALIA (fig. 26): See generic description.

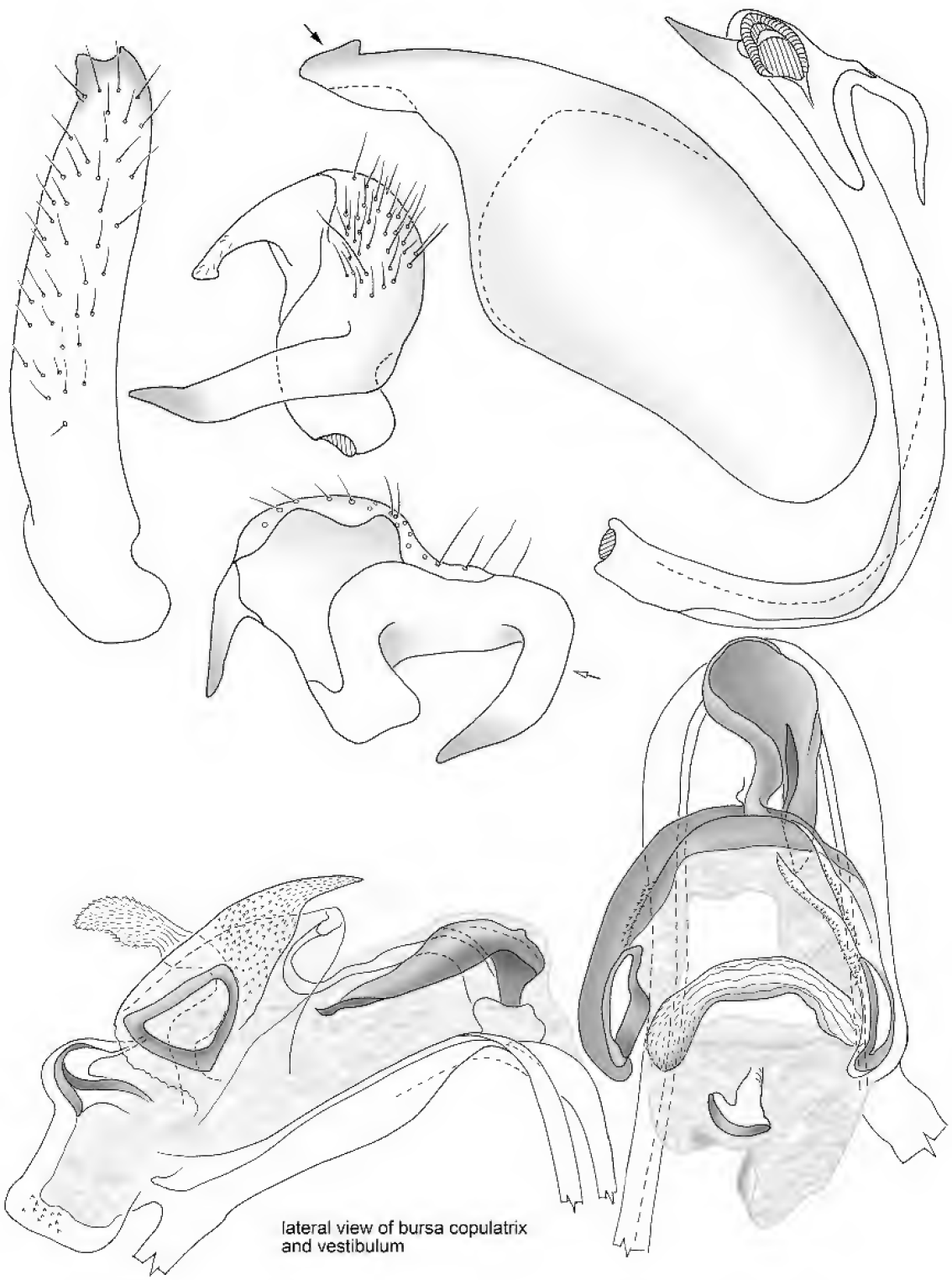


Fig. 25. *Cercocarpopsallus bispinosus:* Male genitalia (AMNH_PBI 00079106); female genitalia (AMNH_PBI 00082240).

ETYMOLOGY: Named for the two prominent spines attending the secondary gonopore in the male vesica.

HOST: Recorded from *Cercocarpus betuloides* Nutt. ex T. & G. and *Cercocarpus ledifolius* Nutt. (Rosaceae).

DISTRIBUTION (map 5): Known from the foothills of the Sierra Nevada Mountains in northern California south to Riverside County, ranging east to the Wasatch Range in western Utah.

HOLOTYPE: **USA: Utah:** ***Box Elder Co.:*** 5 mi SW of Clear Creek Campground, Raft River Mountains [41.94517°N 113.35486°W], 2164 m, 31 Jul 1981, M.D. Schwartz, *Cercocarpus ledifolius* (Rosaceae), 1♂ (AMNH_PBI 00063147) (AMNH).

PARATYPES: **USA: California:** ***Kern Co.:*** 20 km W of Wofford Heights on Rt 155, 35.70694°N 118.6764°W, 1500 m, 26 Jul 1999, M.D. Schwartz, *Cercocarpus betuloides* Nutt. ex T. & G. (Rosaceae), 2♂ (AMNH_PBI 00071592, AMNH_PBI 00071593), 9♀ (AMNH_PBI 00071595–AMNH_PBI 00071603) (CNC). 44.6 km E of jct with Rt 65 on Rt 155, W of Glennville, 35.72889°N 118.20954°W, 1000 m, 26 Jul 1999, M.D. Schwartz, *Cercocarpus betuloides* Nutt. ex T. & G. (Rosaceae), 2♂ (AMNH_PBI 00071859, AMNH_PBI 00071860), 1♀ (AMNH_PBI 00071861) (AMNH). *Cercocarpus betuloides* Nutt. ex T. & G. (Rosaceae), 4♂ (AMNH_PBI 00071589–AMNH_PBI 00071591, AMNH_PBI 00071594) (CNC). ***Lassen Co.:*** 9 mi W of McArthur, 41.33167°N 120.70966°W, 1280 m, 06 Jul 1979, R.T. and Joe Schuh, *Cercocarpus betuloides* (Rosaceae), 3♂ (AMNH_PBI 00062046, AMNH_PBI 00063295, AMNH_PBI 00063296), 5♀ (AMNH_PBI 00063297, AMNH_PBI 00063301) (AMNH). ***Riverside Co.:*** 5 mi S of Palm Springs, Palm Canyon, 33.75799°N 116.54444°W, 08 Jun 1978–05 Jul 1978, J.D. Pinto, 4♂ (AMNH_PBI 00082885–AMNH_PBI 00082888) (UCR). ***San Bernardino Co.:*** Mill Creek, 34.08721°N 117.11396°W, 1829 m, 04 Sep 1944, Timberlake, *Cercocarpus ledifolius* (Rosaceae), 6♂ (AMNH_PBI 00082226–AMNH_PBI 00082229, AMNH_PBI 00082293, AMNH_PBI 00082294), 10♀ (AMNH_PBI 00082238–AMNH_PBI 00082245, AMNH_PBI 00082295, AMNH_PBI 00082296) (UCR); 29 Jul 1944, Timberlake, *Cercocarpus ledifolius* (Rosaceae), 2♂ (AMNH_PBI 00082230, AMNH_PBI 00082231) (UCR); 27 Aug 1945, Timberlake, *Cercocarpus ledifolius* (Rosaceae), 1♂ (AMNH_PBI 00082232), 3♀ (AMNH_PBI 00082248–AMNH_PBI 00082250) (UCR); 21 Jul 1950, Timberlake, *Cercocarpus ledifolius* (Rosaceae), 2♂ (AMNH_PBI 00082233, AMNH_PBI 00082236) (UCR); 16 May 1947, Timberlake, *Cercocarpus ledifolius* (Rosaceae), 1♂ (AMNH_PBI 00082234) (UCR); 01 Sep 1947, Timberlake, *Cercocarpus ledifolius* (Rosaceae), 1♂ (AMNH_PBI 00082235) (UCR); 10 Jul 1940, Timberlake, *Cercocarpus betuloides* (Rosaceae), 2♀ (AMNH_PBI 00082246, AMNH_PBI 00082247) (UCR); 13 Aug 1945, Timberlake, *Cercocarpus ledifolius* (Rosaceae), 2♀ (AMNH_PBI 00082251, AMNH_PBI 00082252) (UCR); 02 Jul 1947, Timberlake, *Cercocarpus ledifolius* (Rosaceae), 1♀ (AMNH_PBI 00082253) (UCR); 16 Jul 1947, Timberlake, *Cercocarpus ledifolius* (Rosaceae), 1♀ (AMNH_PBI 00082254) (UCR); 02 Aug 1947, Timberlake, *Cercocarpus ledifolius* (Rosaceae), 1♀ (AMNH_PBI 00082255) (UCR); 21 Jul 1947, Timberlake, *Cercocarpus ledifolius* (Rosaceae), 1♀ (AMNH_PBI 00082256) (UCR). Mount San Antonio, 34.28888°N 117.64666°W, 1676 m, 22 Aug 1920, Timberlake, *Cercocarpus betuloides* (Rosaceae), 1♂ (AMNH_PBI 00082237), 2♀ (AMNH_PBI 00082257, AMNH_PBI 00082258) (UCR). ***Shasta Co.:*** 1 mi W of Fall River Mills, 41.08058°N 121.46683°W, 1030 m, 07 Jul 1979, R.T. and Joe Schuh, *Cercocarpus betuloides* (Rosaceae), 1♂ (AMNH_PBI 00062047) (AMNH). Brown Butte, 40.83472°N 121.52861°W, 07 Jul 1947, R.L. Usinger, 1♂ (AMNH_PBI 00079107) (UCB). ***Tehama Co.:*** 10 mi W of Mineral, 40.34762°N 121.78405°W, 27 Jun 1966, O'Brien, 1♂ (AMNH_PBI 00079106) (UCB). ***Tulare Co.:*** Mineral King Rd E of Three Rivers, 36.47356°N 118.8465°W, 492 m, 24 May 2004, Schuh, Cassis, Schwartz, Weirauch, Wyniger, Forero, *Cercocarpus betuloides* Torr. & A. Gray (Rosaceae), det. A. Sanders UCR140579, 6♂ (AMNH_PBI 00170503–AMNH_PBI 00170508) (AMNH). **Nevada:** ***Clark Co.:*** Charleston Peak, 36.27222°N 115.69417°W, 2286 m, 19 Jul 1982, J.T. Polhemus, 1♂ (AMNH_PBI 00063963) (JTP). **Utah:** ***Box Elder Co.:*** 5 mi SW of Clear Creek Campground, Raft River Mountains, 41.94517°N 113.35486°W, 2164 m, 31 Jul 1981, M.D. Schwartz, *Cercocarpus ledifolius* (Rosaceae), 15♂ (AMNH_PBI 00063146, AMNH_PBI 00063269–AMNH_PBI 00063282), 12♀ (AMNH_PBI 00063148, AMNH_PBI 00063149, AMNH_PBI 00063285, AMNH_PBI 00063294) (AMNH). *Cercocarpus ledifolius* (Rosaceae), 2♂ (AMNH_PBI 00063267, AMNH_PBI 00063268), 2♀ (AMNH_PBI 00063283, AMNH_PBI 00063284) (USNM). ***Summit Co.:*** 4.5 mi E of Oakley, Weber Canyon Road, 40.71472°N 111.21417°W, 19 Aug 1986, G.M. Stonedahl, *Cercocarpus* sp. (Rosaceae), 1♂ (AMNH_PBI 00096932) (AMNH).

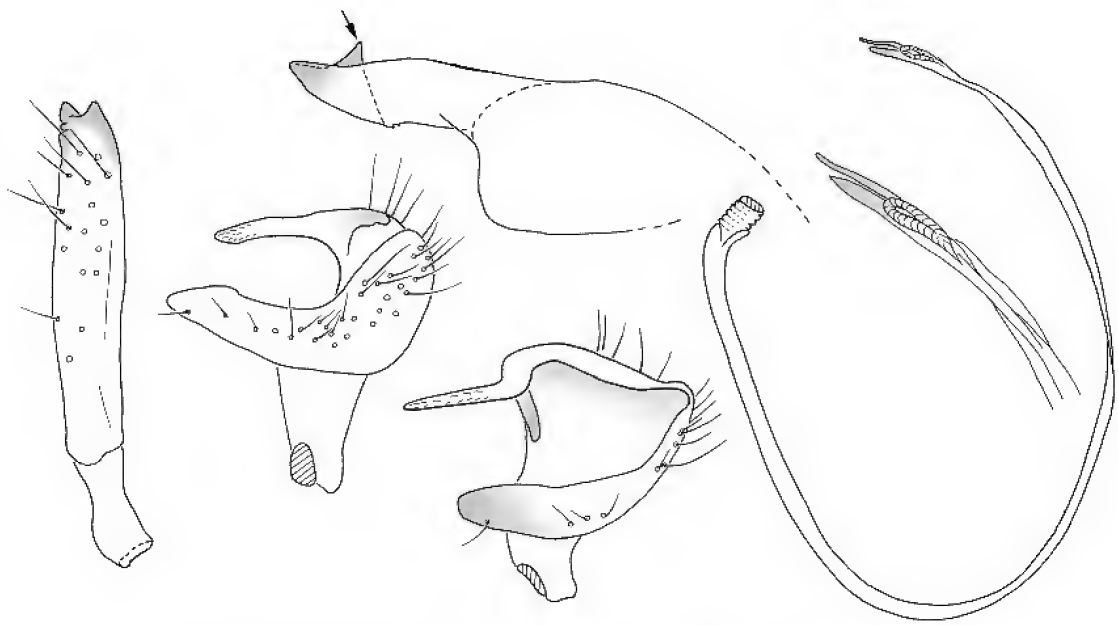


Fig. 26. *Cercocarpopsallus gracilis:* Male genitalia (AMNH_PBI 00075917).

Cercocarpopsallus gracilis, new species
figures 3, 26; map 5

DIAGNOSIS: Recognized, in conjunction with the green spotting on he hemelytra (fig. 3) and the field of spicules on the left side of the pygophore (fig. 24C), by the filamentous vesica with its two relatively short, slender, parallel apical spines (fig. 26).

DESCRIPTION: *Male:* Size moderate among *Phymatopsallus*-group taxa, elongate, nearly parallel-sided, total length 3.05–3.18, length apex clypeus–cuneal fracture 2.00–2.17, width pronotum 0.92–0.98. COLORATION (fig. 3): Pale, faded greenish, with moderately dense covering of brown spots on clavus, corium, and cuneus; membrane boldly marmorate with broad dark areas over much of membrane, veins pale to infuscate. SURFACE AND VESTITURE (figs. 3, 24C): As in generic description. STRUCTURE: Head: Labium reaching hindmargin of hind trochanters. GENITALIA (fig. 26): Vesica: Filamentous, apex with two slender, parallel spines about the length of secondary gonopore. Parameres: Left paramere with anterior process flattened and relatively broad, posterior process slender, with acute apex.

Female: Elongate ovoid; total length 2.75–3.12, length apex clypeus–cuneal fracture 1.95–2.20, width pronotum 0.94–1.00. COLORATION (fig. 2): As in male. SURFACE AND VESTITURE: As in male. STRUCTURE: Similar to male. GENITALIA (genitalia examined, not illustrated): Similar in structure to those of *Cercocarpopsallus bispinosus*.

ETYMOLOGY: Named for the slender nature of the vesica, especially in contrast with *C. bispinosus*.

HOST: Recorded only from *Cercocarpus betuloides* (Rosaceae).

DISTRIBUTION (map 5): Known from Harney and Wheeler Counties in Central Oregon south to the foothills of the Sierra Nevada Mountains in Kern County, California.

HOLOTYPE: **USA: California:** ***Kern Co.:*** 44.6 km E of jct with Rt 65 on Rt 155, W of Glennville, 35.72889°N 118.20954°W, 1000 m, 26 Jul 1999, M.D. Schwartz, *Cercocarpus betuloides* Nutt. (Rosaceae), 1♂ (AMNH_PBI 00071864) (CNC).

PARATYPES: **USA: California:** ***Kern Co.:*** 44.6 km E of jct with Rt 65 on Rt 155, W of Glennville, 35.72889°N 118.20954°W, 1000 m, 26 Jul 1999, M.D. Schwartz, *Cercocarpus betuloides*

(Rosaceae), 2♂ (AMNH_PBI 00071862, AMNH_PBI 00071863), 4♀ (AMNH_PBI 00071865–AMNH_PBI 00071868) (AMNH). 3♂ (AMNH_PBI 00071604–AMNH_PBI 00071606), 8♀ (AMNH_PBI 00071608–AMNH_PBI 00071615) (CNC). 1♂ (AMNH_PBI 00071607), 1♀ (AMNH_PBI 00071616) (USNM). **Oregon:** ***Harney Co.:*** 18 mi N of Burns, 43.84711°N 119.05306°W, 14 Aug 1971, Oman, 2♂ (AMNH_PBI 00075920, AMNH_PBI 00075923) (AMNH). 5♂ (AMNH_PBI 00075905–AMNH_PBI 00075909) (ORSU). ***Wheeler Co.:*** 13 mi SW of Mitchell, 44.43808°N 120.34371°W, 31 Jul 1972, Oman, 5♂ (AMNH_PBI 00075916–AMNH_PBI 00075919, AMNH_PBI 00075922) (AMNH). 6♂ (AMNH_PBI 00075910–AMNH_PBI 00075915) (ORSU).

Knightopsallus, new genus

Type species: *Knightopsallus portalensis*, new species.

DIAGNOSIS: Recognized by the small to moderate size among *Phymatopsallus*-group taxa (fig. 3), average total length 2.49, uniformly greenish coloration (often faded in preserved specimens) (fig. 3), the cylindrical antennal segment 2 (figs. 3, 27D) and the large eyes in the males (fig. 3), the absence of a seta-covered tubercle on the left side of the pygophore (fig. 27E), the pointed process on the anterior surface of the phallotheca (fig. 28), and the slender vesica lacking spines or other ornamentation on the shaft (fig. 28). Most readily confused with *Phymatopsallus* species because of the nearly identical coloration, size, and conformation of the head and body (fig. 3); males readily distinguished by the absence of the tubercle on the left side of the pygophore in *Knightopsallus*. Also similar in size, coloration, and general appearance to *Angelopsallus gregalis*, but distinguished by the small eyes in the males and slightly tapered antennal segment 2 in that species, in addition to the details of male genitalic structure, *A. gregalis* with a single ventral spine on the phallotheca and a very long, flattened, parallel-sided right paramere, in contrast to the anterior phallothecal "spine" and less elongate, less strongly parallel-sided right paramere in *Knightopsallus*.

DESCRIPTION: *Male:* Size small to moderate among *Phymatopsallus*-group taxa, moderately elongate, nearly parallel-sided, total length 2.17–2.70, length apex clypeus–cuneal fracture 1.49–1.78, width pronotum 0.82–0.87. COLORATION (fig. 3): Body and forewings light green to lime green, often faded and yellowish in preserved specimens; eyes often carmine, sometimes silvery or pale; appendages pale, weakly yellowish to greenish; femora with scattered weak brown spots; tibial spines pale, with small weakly brown spots at bases; membrane marmorate, veins tinged with green. SURFACE AND VESTITURE (fig. 3): Dorsal body surface smooth, impunctate, weakly shining. Dorsal vestiture of reclining, silvery, sericeous setae. STRUCTURE: Head: Short, transverse, closely conforming to anterior margin of pronotum; frons weakly protruding beyond anterior margin of eyes; posterior margin of vertex rounded; eyes large in dorsal and lateral views, occupying most of height of head; antennae inserted just above ventral margin of eyes, eyes very weakly emarginate at antennal insertion; antennal segment 2 cylindrical, not tapered, about the same diameter as antennal segment 1 (fig. 27D); labium reaching to apex of hind coxae. Thorax: Mesothoracic spiracle and metathoracic scent-efferent system as in figure 27B. *Legs:* Claws moderately elongate, smoothly curving, pulvilli small, flaplike, reaching middle of claw, parempodia setiform (fig. 27C). Abdomen: Broad. GENITALIA (figs. 27E, F, 28): Pygophore: Conical, lacking tubercle and associated setae on left side (figs. 27E). Vesica: Formed of a single relatively slender strap, J-shaped, with one-half twist before apex, apically attenuated, extending beyond secondary gonopore by less than length of gonopore; secondary gonopore small, ovoid, without distinct gonopore sclerite. Phallotheca: With apical portion tapered, relatively short, with a tapered process on posterior margin. Parameres: Left paramere of form found in many Phylini, with truncate posterior process; right paramere only slightly enlarged and elongate, weakly tapered on apical one-third, truncate apically, lying over phallotheca and left paramere in repose.

Female: Not positively associated with males.

ETYMOLOGY: Named in honor of Harry H. Knight in recognition of his pioneering

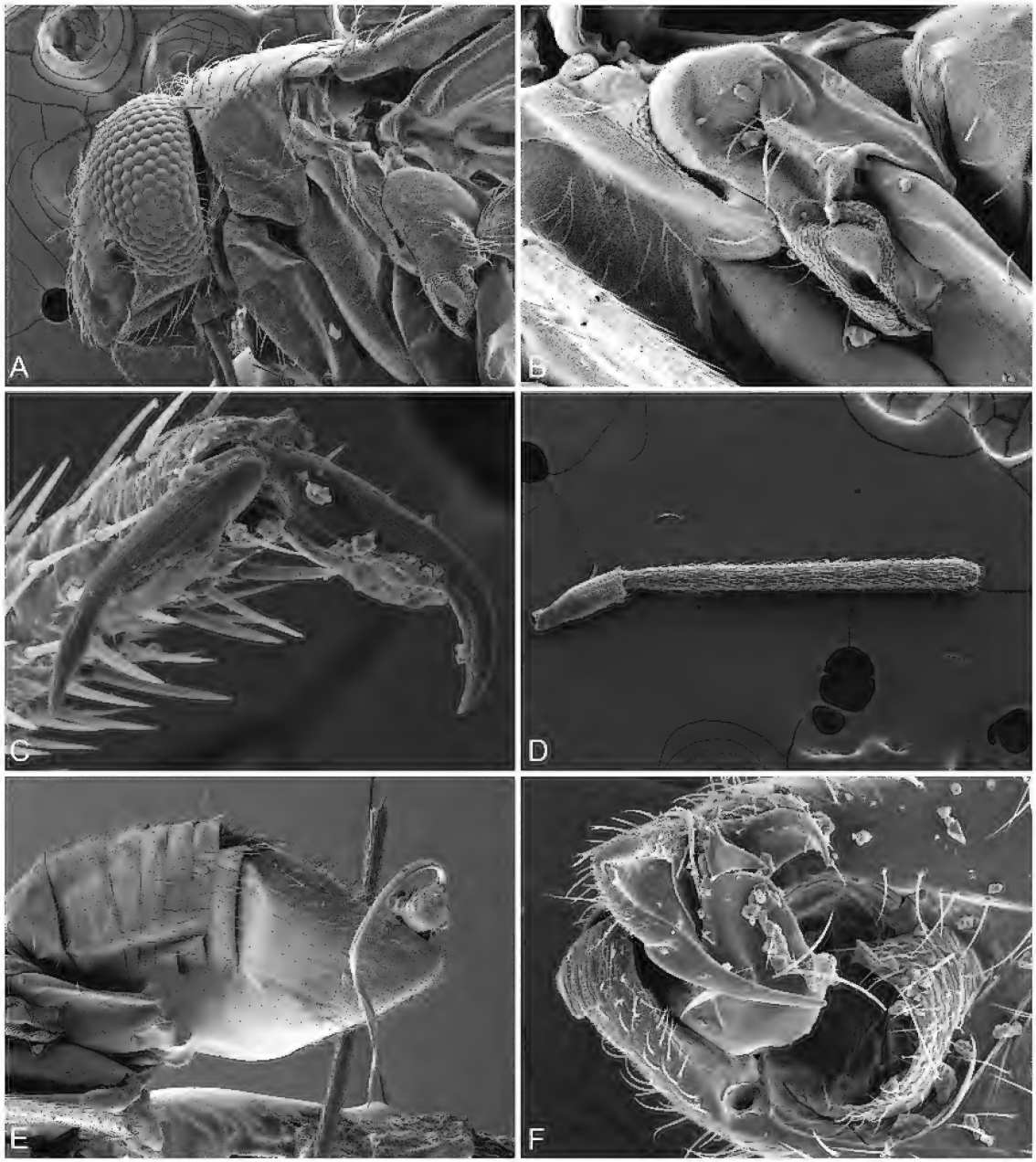


Fig. 27. *Knightopsallus portalensis*. **A.** Lateral view of head. **B.** Mesothoracic spiracle and metathoracic scent-efferent system. **C.** Frontal view of pretarsus. **D.** Antennal segments 1 and 2. **E.** Lateral view of male abdomen, showing extruded vesica. **F.** Dorsal view of male pygophore (right paramere missing).

work on the *Phymatopsallus* group, in combination with the generic name *Psallus*. Gender masculine.

HOST: *Acacia* sp. (Fabaceae).

DISCUSSION: This currently monotypic taxon is remarkably similar in appearance to *Phymatopsallus* spp. The absence of a tubercle on the left side of the pygophore

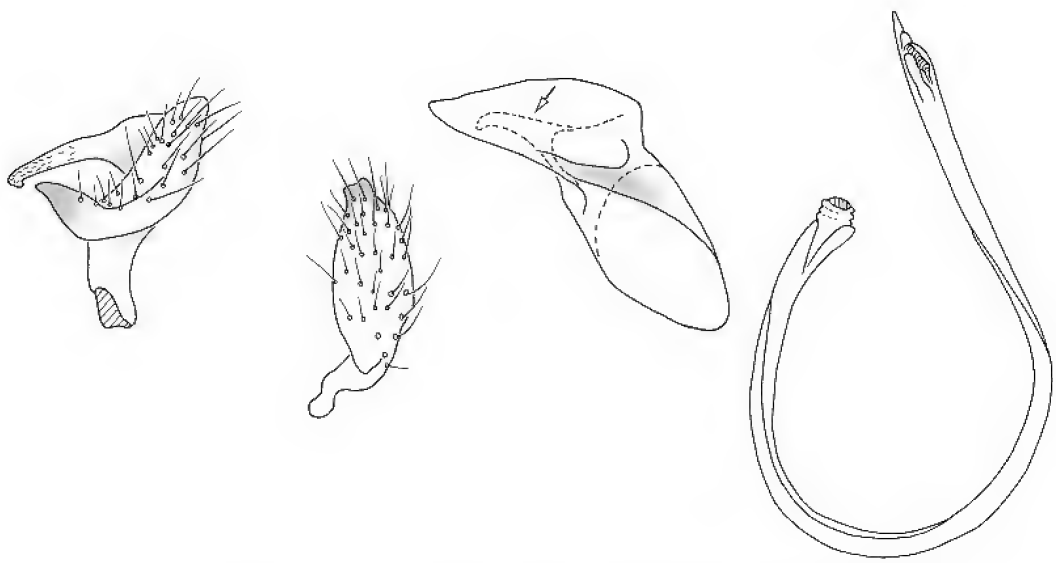


Fig. 28. *Knightopsallus portalensis:* Male genitalia (AMNH_PBI 00062707).

will distinguish *Knightopsallus* from *Phymatopsallus*, as will the structure of the frequently extruded vesica.

Because I have not been able to positively associate female specimens of *Knightopsallus*, no measurements or genitalic illustrations are provided for the females.

Knightopsallus portalensis, new species
figures 3, 27, 28; map 5

DIAGNOSIS: See generic diagnosis.

DESCRIPTION: See generic description.

HOSTS: Recorded from *Acacia* sp. (Fabaceae). The long series of specimens from Portal, Arizona, was collected at light in association with *Phymatopsallus rinconae* Knight. The environment where these collections were made was a *Prosopis/Acacia/Larrea* scrub habitat, the type of situation where colleagues, I, and others have collected intensively on a broad cross section of potential hosts. Nonetheless, very few verified host records are available for *K. portalensis*.

ETYMOLOGY: Named for its occurrence near Portal, Arizona, the area where most known specimens have been collected.

DISTRIBUTION (map 5): Known from Cochise and Maricopa Counties in southern Arizona.

DISCUSSION: Knight (1964) labeled an undissected male specimen (AMNH_PBI 00069797) as the holotype of *Phymatopsallus chiricahuae* Knight, even though this specimen lacked the diagnostic characteristics of his new species. This specimen is here treated as a paratype of *Knightopsallus portalensis*, new species, and it bears and additional label to that effect. Two other conspecific male specimens with the same locality data were labeled by Knight as "autotypes" of *Phymatopsallus chiricahuae*; they have the vesica extruded and readily visible, lack a tubercle on the left side of the pygophore, do not have the thumblike process on the dorsal margin of the left paramere, and do not have a medial vesical spine. All of these attributes make it clear that these specimens do not represent a *Phymatopsallus* sp. Rather, they are conspecific with the specimen discussed above, which bears Knight's holotype label, and are also treated as paratypes of *Knightopsallus portalensis*. (See also discussion under *Phymatopsallus rinconae* Knight.)

HOLOTYPE: **USA: Arizona:** ***Cochise Co.:*** Portal [31.91361°N 109.14083°W], 1500 m, 15 Jun 1980, R.T. Schuh and K. Schmidt, 1♂ (AMNH_PBI 00063145) (AMNH).

PARATYPES: **USA: Arizona:** ***Cochise Co.:*** Chiricahua Mountains, 31.59222°N 109.24°W,

1885 m, 20 Jun 1928, A.A. Nichol, 3♂ (AMNH_PBI 00068592, AMNH_PBI 00068608, AMNH_PBI 00069797) (USNM). Portal, 31.91361°N 109.14083°W, 1500 m, 15 Jun 1980, R.T. Schuh and K. Schmidt, 3♂ (AMNH_PBI 00063142–AMNH_PBI 00063144) (AMNH); 15 Jun 1980, R.T. Schuh, K. and R. Schmidt, 36♂ (AMNH_PBI 00062673–AMNH_PBI 00062695, AMNH_PBI 00062697–AMNH_PBI 00062709) (AMNH). ***Maricopa Co.:*** 5 mi S of Freeman SE of Gila Bend, 32.77354°N 112.29583°W, 625 m, 08 May 1978, R.T. Schuh and A.F. Guenther, *Acacia* sp. (Fabaceae), 1♂ (AMNH_PBI 00062696) (AMNH).

Phymatopsallus Knight

Phymatopsallus Knight, 1964: 127 (n.gen.).

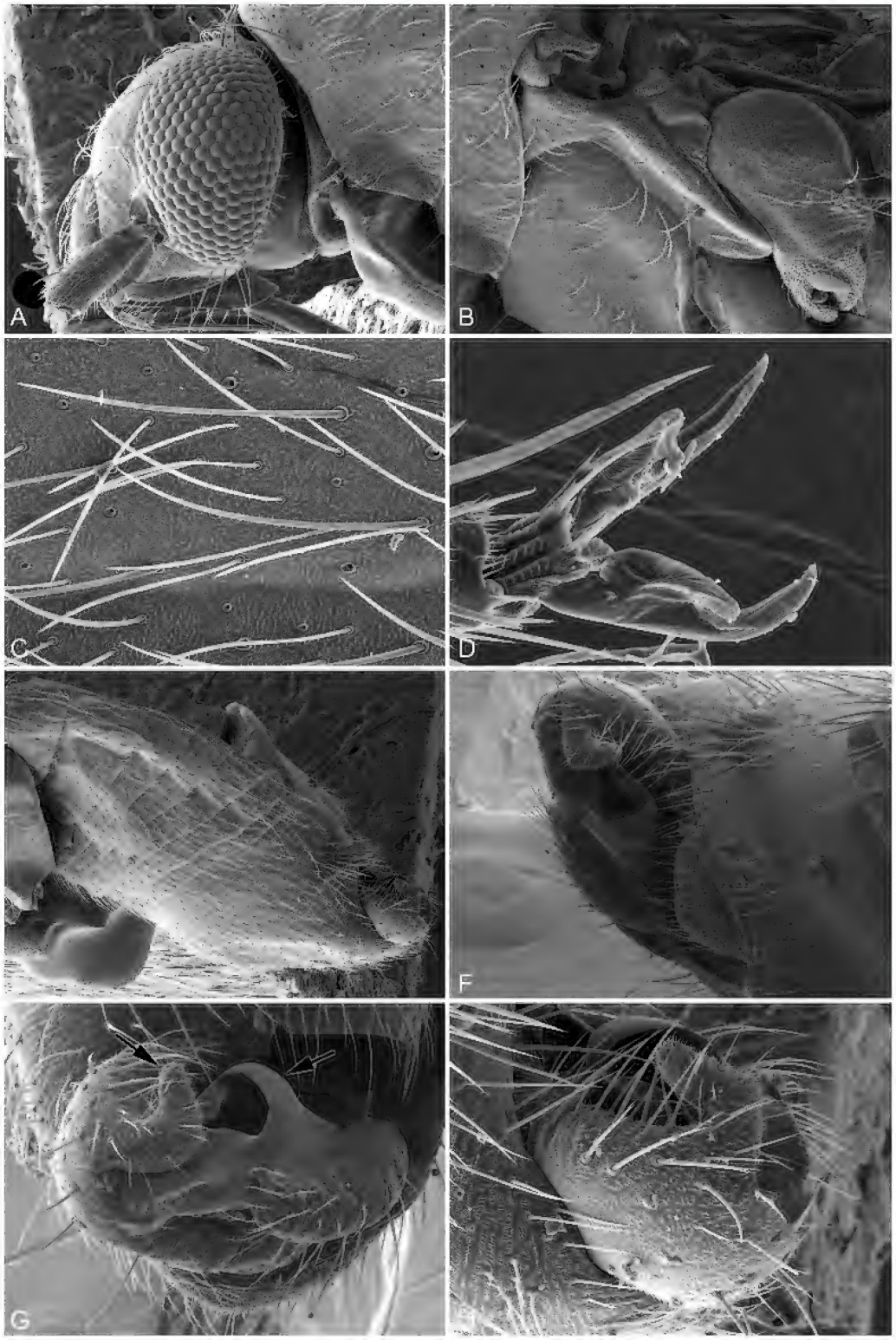
Type species: *Phymatopsallus strombocarpae* Knight (= *Psallus tuberculatus* Van Duzee).

Sonoraphylus Carvalho and Costa, 1992: 119 (n. gen.). NEW SYNONYMY.

Type species: *Sonoraphylus hermosillensis* Carvalho and Costa, 1992 (= *Phymatopsallus patagoniae* Knight, 1964).

DIAGNOSIS: Recognized by the pale green to lime green coloration, often turning yellowish in preserved specimens, in conjunction with the marmorate membrane (fig. 3), the pygophore always with a tubercle on left side (fig. 29E, F), and consistently by the following characters of the male genitalia: the vesical shaft with a slender "medial" spine located proximad of the secondary gonopore (figs. 30–34), the phallotheca ornamented with numerous small protuberances on dorsal margin near the apex and a blunt, finger-like projection ("spine") on the anterior surface, and the left paramere with a distinctive projection on the dorsal margin of the anterior surface (figs. 29G, H, 30–34). Distinguished from nearly all other Phylinae by its possession of a medial vesical spine, a feature found elsewhere only in species of *Pilophorus* Hahn, the produced dorsal margin of the anterior surface of the left paramere, and the small protuberances on the apicodorsal margin of the phallotheca. Similar in general appearance and size to the monochromatic taxa *Angelopsallus gregalis* and *Knightopsallus portalensis*, but males easily distinguished by the presence of a seta-covered tubercle on the left side of the pygophore in *Phymatopsallus* and the absence of that structure in *K. portalensis* and *A. gregalis*, and by the distinctive features of the vesica, phallotheca, and left paramere, as mentioned above, in *Phymatopsallus*.

REDESCRIPTION: *Male:* Size very small to moderate among *Phymatopsallus*-group taxa, weakly to moderately elongate, nearly parallel-sided, total length 1.92–3.11, length apex clypeus–cuneal fracture 1.34–2.03, width pronotum 0.68–1.01. COLORATION (fig. 3): Body and forewings light green to lime green, often faded and yellowish in preserved specimens; eyes often carmine, sometimes silvery or pale; appendages pale, weakly yellowish to greenish; femora with scattered weak brown spots; tibial spines pale, with small weakly brown spots at bases; membrane weakly marmorate, veins tinged with green. SURFACE AND VESTITURE (figs. 3, 29C): Dorsal body surface smooth, impunctate, weakly shining. Dorsal vestiture of reclining, pale, simple setae intermixed with recumbent, silvery, sericeous setae. STRUCTURE: Head: Short, transverse, closely conforming to anterior margin of pronotum; frons at most barely protruding beyond anterior margin of eyes; posterior margin of vertex rounded (fig. 3); eyes in most species large in dorsal and lateral views (fig. 3), sometimes smaller and with greater interocular distance (e.g., *acaciae*) (fig. 3, 29A); antennae inserted just above ventral margin of eyes, eyes not emarginate at antennal insertion (fig. 29A); antennal segment 2 cylindrical, not tapered, about the same diameter as antennal segment 1 (fig. 3); labium reaching from posterior margin of middle trochanters to posterior margin of hind trochanters. Thorax: Mesothoracic spiracle and metathoracic scent-efferent system as in figure 29B. *Legs:* Claws moderately elongate, rather strongly curving, pulvilli small, attached near base of claws and extending slightly past midpoint of claw, parempodia setiform (fig. 29D). Abdomen: Broad. GENITALIA (figs. 29E–H, 30–34): Pygophore: Relatively large, occupying about half the length of abdomen, on left side with a distinct tubercle beset with numerous long setae (fig. 29E, F). Vesica:


A
B
C
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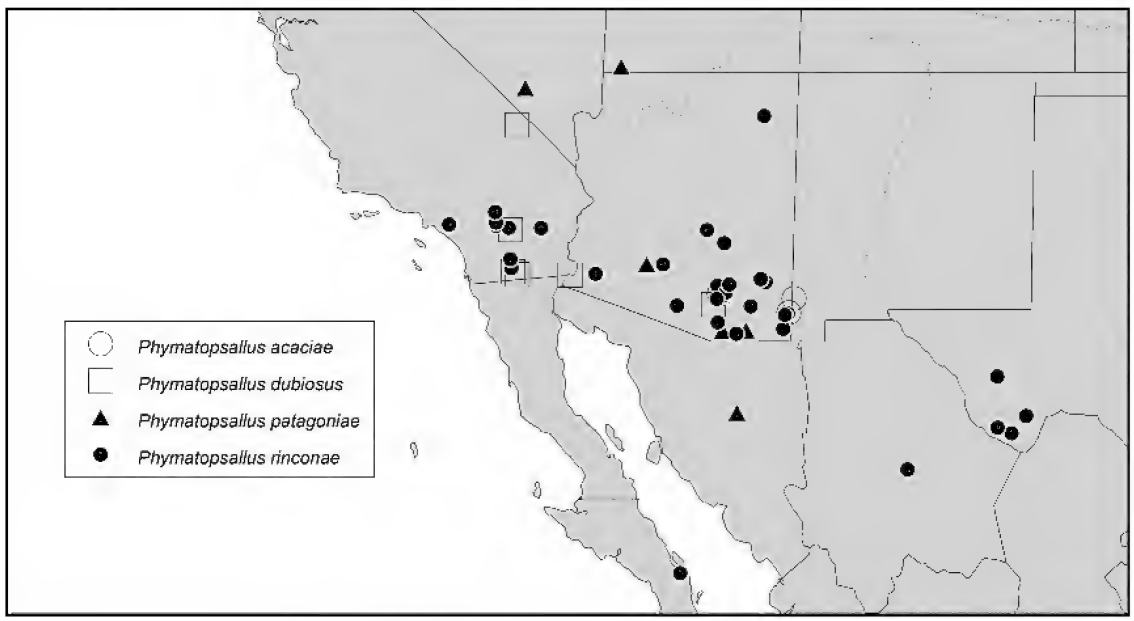
F
G



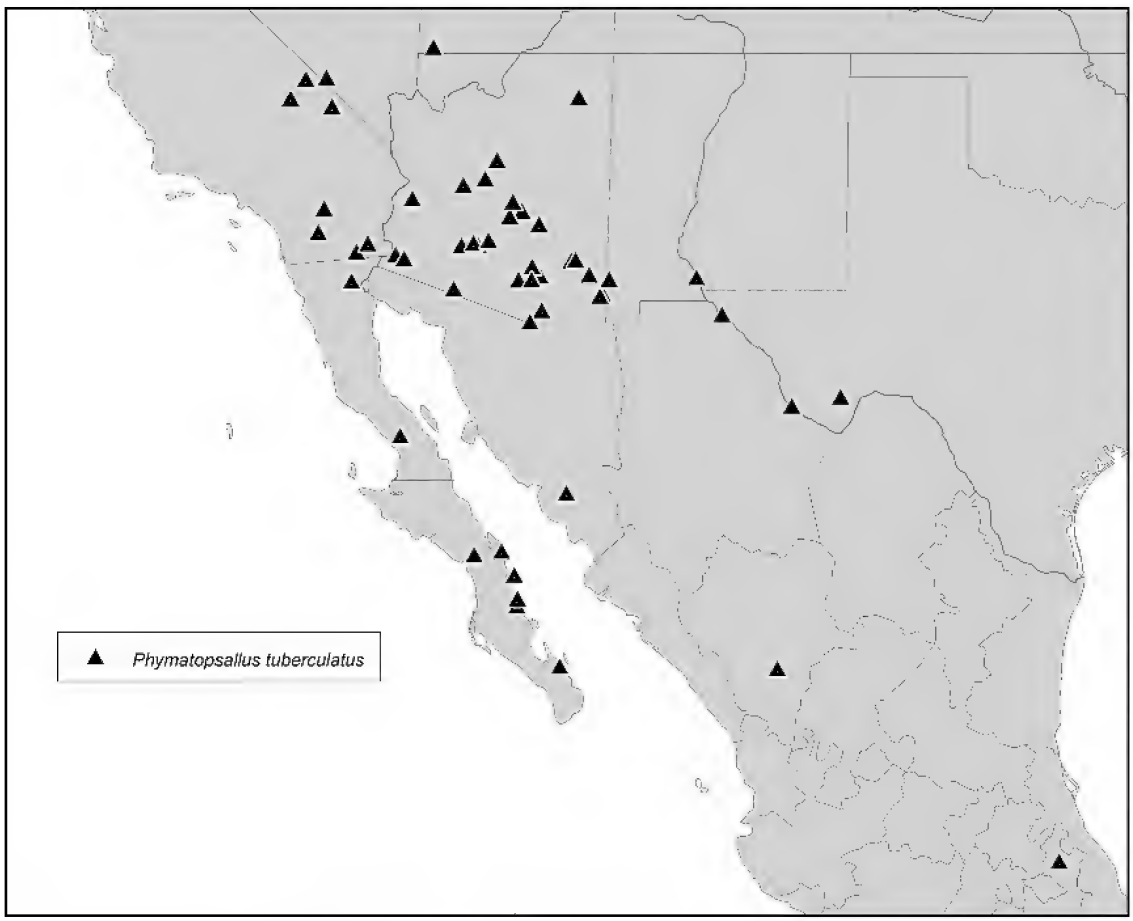
Map 6. Distribution of *Phymatopsallus acaciae–P. rinconae.*

Formed of a single relatively slender strap, appearing tubular over much of length, varying from C-shaped to J-shaped, with at most one-half twist, with a simple spine of varying length located proximad of secondary gonopore, apically attenuated and extending well beyond secondary gonopore; secondary gonopore well sclerotized, ovoid, without distinct gonopore sclerite. Phallotheca: With apical portion rather short and blunt, dorsal margin near apex ornamented with many small spines or protuberances, weakly keel-like, anterior surface with a thumblike process ("spine"). Parameres: Left paramere with a distinctive broad projection on the dorsal margin of the anterior surface near apex, anterior process elongate, attenuated, posterior process elongate, truncate; right paramere relatively large, elongate, apex weakly to moderately broad, pair of apical processes weakly developed, and paramere lying over phallotheca and left paramere in repose.

Female: Elongate ovoid in contrast to nearly parallel-sided male; total length 1.95–3.30, length apex clypeus–cuneal fracture 1.38–2.30, width pronotum 0.66–0.99. COLORATION (fig. 3): As in male. SURFACE AND VESTITURE: As in male. STRUCTURE: Hemelytra just covering abdomen; eyes smaller than those of male, frons more prominently bulging anterior to eyes, head projecting below eyes by distance roughly equal to diameter of antennal segment 1; antennal segment 2 more slender than in male, tapered toward base (fig. 3). GENITALIA (figs. 30, 34): Sclerotized rings large, more or less quadrangular; vestibulum short, with vestibular sclerites connecting from base of ovipositor valves directly to bursa copula-

←

Fig. 29. *Phymatopsallus rinconae.* **A.** Lateral view of head. **B.** Mesothoracic spiracle and metathoracic scent-efferent system. **C.** Setae on hemelytron. **D.** Ventral view of pretarsus. **E.** Lateral view of male abdomen. **F.** Dorsal view of pygophore. **G.** Posterior view of pygophore (left arrow indicates thumblike process on dorsal margin of left paramere; right arrow indicates spine on anterior surface of phallotheca). **H.** Detail of left paramere, showing thumblike process on dorsal margin.



Map 7. Distribution of *Phymatopsallus tuberculatus.*

trix; posterior wall simple, anterior portion with microtrichia, posterior third with overlapping crescentic pattern with marginal microtrichia.

HOSTS: All known host records for *Phymatopsallus* spp. are from the Fabaceae.

DISCUSSION: Knight (1964) diagnosed his new genus *Phymatopsallus* as having simple as well as sericeous, woolly pubescence on the dorsum, a tubercle on the left side of the pygophore, a conspurcate (= marmorate) membrane, and dark spots at the base of the tibial spines. Although all of the species here placed in *Phymatopsallus* possess those characters, none is unique to the group, and as a consequence many of the species placed in *Phymatopsallus* by Knight (1964) are here placed in other genera. The medial spine on the vesica and the broad dorsal projection on the anterior surface of the left paramere allow *Phymatopsallus* sensu stricto to be distinguished unequivocally; these characters are therefore incorporated into the revised generic diagnosis.

Carvalho and Costa (1992) described the genus *Sonoraphylus* on the basis of two specimens from near Hermosillo, Sonora, Mexico. This taxon is clearly congeneric with *Phymatopsallus* Knight, based on size, coloration, and the structure of the vesica with a medial spine and is therefore being treated as a junior synonym.

KEY TO MALES OF *PHYMATOPSALLUS*

1. Medial vesical spine very long, approximately one-third the length of vesica (figs. 33, 34) 2
– Medial vesical spine much shorter, at most one-fourth the length of vesica (figs. 30–32) 3

2. Medial vesical spine inserted relatively close to secondary gonopore, distance equal to less that half the length of spine; vesica not twisted on apical two-fifths, portion apical of secondary gonopore straight in lateral view (fig. 34). . . . . *tuberculatus* (Van Duzee)
– Medial vesical spine inserted farther from secondary gonopore, distance equal to more than half the length of spine; vesica twisted on apical two-fifths, portion apical of secondary gonopore weakly curving in lateral view (fig. 33). . . . *rinconae* Knight
3. Small species, total length 2.17 or les table 1); eyes small (fig. 3) . . . . . *acaciae* Knight
– Larger species, total length always greater than 2.36 (table 1); eyes larger (fig. 3). . . 4
4. Medial vesical spine very short, removed from secondary gonopore by distance about equal to length of spine (fig. 31) . . . . . *dubiosus* (Van Duzee)
– Medial vesical spine somewhat longer, removed from secondary gonopore by distance slightly less than length of spine (fig. 32). . . . . *patagoniae* Knight

Phymatopsallus acaciae Knight
figures 3, 30; map 6

Phymatopsallus acaciae Knight, 1964: 131 (n.sp.).

DIAGNOSIS: Recognized by the very small size among *Phymatopsallus* spp., average total length 2.08, relatively small eyes and broad vertex in the males, and the structure of the male genitalia, the vesica being C-shaped, and the medial spine flattened, bladelike, of moderate length, with the point of insertion removed from secondary gonopore by a distance approximately equal to length of spine (fig. 30). Distinguished from other *Phymatopsallus* spp. by the smaller size in *P. acaciae*, total length always less than 2.20, the relatively small eyes in the males, the bladelike medial spine on the vesica substantially removed from the secondary gonopore, that distance equal only to that found in *P. rinconae* (fig. 33), but medial spine in *P. rinconae* about 50% longer than that in *P. acaciae*.

DESCRIPTION: *Male:* Very small, total length 1.99–2.17, length apex clypeus–cuneal fracture 1.34–1.50, width pronotum 0.68–0.78. COLORATION (fig. 3): Lime green. SURFACE AND VESTITURE (figs. 3, 29C): As in generic description. STRUCTURE: Head: Frons weakly protruding beyond anterior margin of eyes; eyes relatively small, appearing as in female (figs. 3, 29A), ratio total width of head:width of vertex 0.54:0.32; labium reaching hindmargin of hind trochanters. GENITALIA (fig. 30): Vesica: Broadly C-shaped to J-shaped, very weakly twisted, portion apicad of secondary gonopore relatively long and straight; medial spine of moderate length, removed from secondary gonopore by about length of spine. Phallotheca: Thumblike process ("spine") with a distinct elevation along one edge. Parameres: Left paramere with projection on the dorsal margin erect and broad; right paramere roughly parallel-sided over entire length.

Female: Ovoid; total length 1.95–2.15, length apex clypeus–cuneal fracture 1.38–1.52, width pronotum 0.66–0.73. COLORATION (fig. 3): As in male. SURFACE AND VESTITURE: As in male. STRUCTURE: Eyes similar in size to those of male. GENITALIA (fig. 30): See generic description.

HOSTS: *Acacia greggii* A. Gray (Fabaceae) (Knight, 1964), *Lycium berlandieri* Dunal, *Lycium* sp. (Solanaceae), and *Phoradendron californicum* Nutt. (Loranthaceae).

DISTRIBUTION (map 6): Known from extreme southwestern New Mexico and southern Arizona, including localities in Cochise and Pima Counties.

DISCUSSION: The type locality is Steins, New Mexico, in the southwest corner of the state adjacent to the Arizona border. Comparison of measurements and eyes in the holotype male of *P. acaciae* (USNM) with male specimens from nearby Portal, Arizona, indicates that specimens from these two localities are conspecific. I have not been able to locate the two paratype male specimens designated by Knight from the type locality for additional comparisons. Dissection of other specimens—from Tucson and the nearby Santa Catalina Mountains, Arizona—designated as paratypes by Knight (1964), indicates that these specimens are not conspecific with the type, with at least some of them belonging to *Phymatopsallus rinconae* Knight. It would appear that, at least in part, Knight (1964) based his species concepts in *Phymatopsallus* on the plants on which the specimens were collected. Examination of

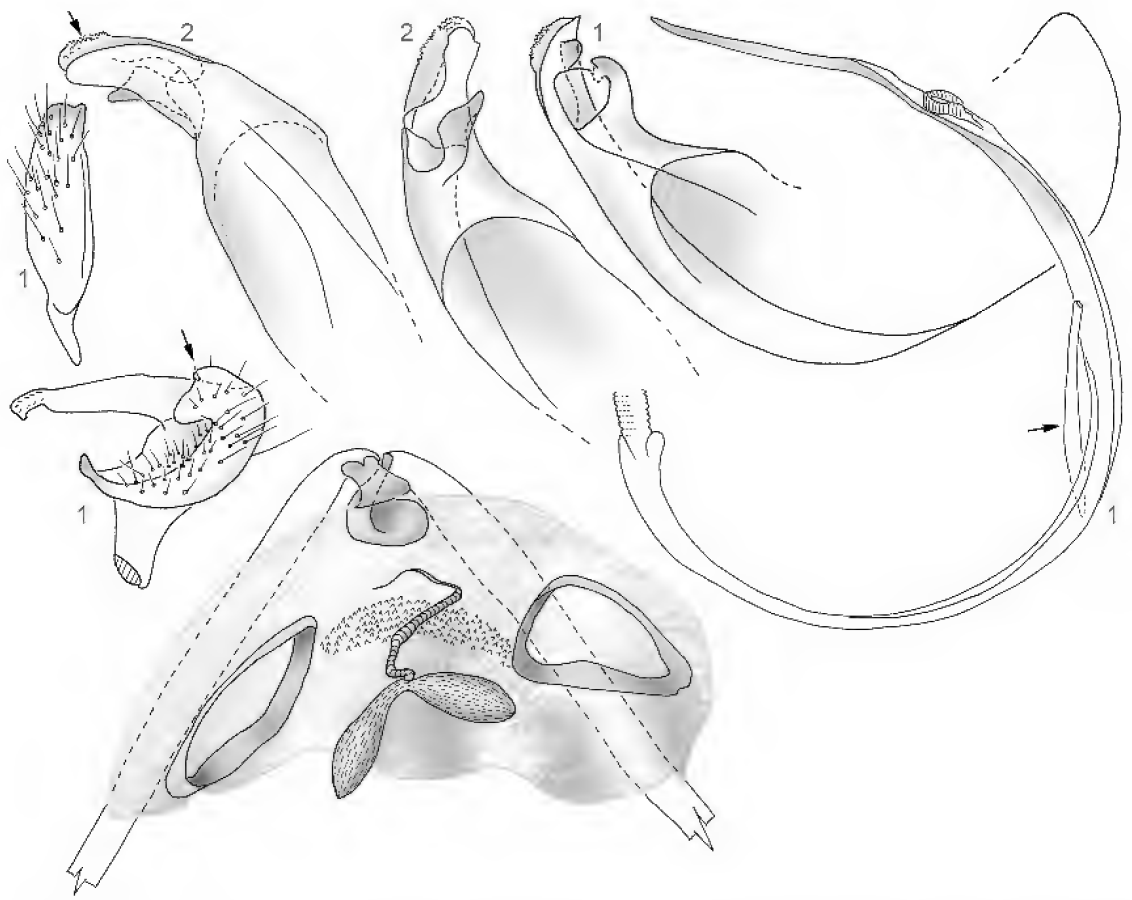


Fig. 30. *Phymatopsallus acaciae:* Male genitalia (male 1, AMNH_PBI 00062324; male 2, 00071888); female genitalia (AMNH_PBI 00097049).

large numbers of genitalic dissections, in combination with other aspects of morphology, indicates that although most *Phymatopsallus* specimens have been collected on legumes, there is no evidence for strong host specificity in the group, and that *P. acaciae* certainly breeds on plants other than *Acacia.*

HOLOTYPE: **USA: New Mexico: *Hidalgo Co.:*** Steins [32.22925°N 108.9895°W, 1324 m], 14 Jul 1917, H.H. Knight, 1♂ (AMNH_PBI 00069808) (USNM).

OTHER SPECIMENS EXAMINED: **USA: Arizona: *Cochise Co.:*** 2 mi NE of Portal, 31.93405°N 109.11673°W, 12 Jun 1980, R.T. Schuh, K. and R. Schmidt, *Lycium* sp. (Solanaceae), 13♂ (AMNH_PBI 00062317–AMNH_PBI 00062325, AMNH_PBI 00063130–AMNH_PBI 00063132, AMNH_PBI 00097042), 28♀ (AMNH_PBI 00097021–AMNH_PBI 00097041, AMNH_PBI 00097043–AMNH_PBI 00097049) (AMNH). ***Pima Co.:*** Santa Catalina Mountains, Ventana Canyon Resort, 32.32638°N 110.86388°W, 29 Aug 1998, M.D. Schwartz, *Lycium berlandieri* Dunal (Solanaceae), 4♂ (AMNH_PBI 00071852, AMNH_PBI 00071885–AMNH_PBI 00071887), 4♀ (AMNH_PBI 00071854, AMNH_PBI 00071858, AMNH_PBI 00071891, AMNH_PBI 00071892) (CNC). Santa Catalina Mountains, Ventana Canyon Trail, 32.33194°N 110.86388°W, 30 Aug 1998, M.D. Schwartz, *Phoradendron californicum* Nutt. (Loranthaceae), 1♂ (AMNH_PBI 00071888), 5♀ (AMNH_PBI 00071855–AMNH_PBI 00071857, AMNH_PBI 00071889, AMNH_PBI 00071890) (CNC).

Phymatopsallus dubiosus (Van Duzee), new combination
figures 3, 31; map 6

Tuponia dubiosa Van Duzee, 1918: 304 (n.sp.).

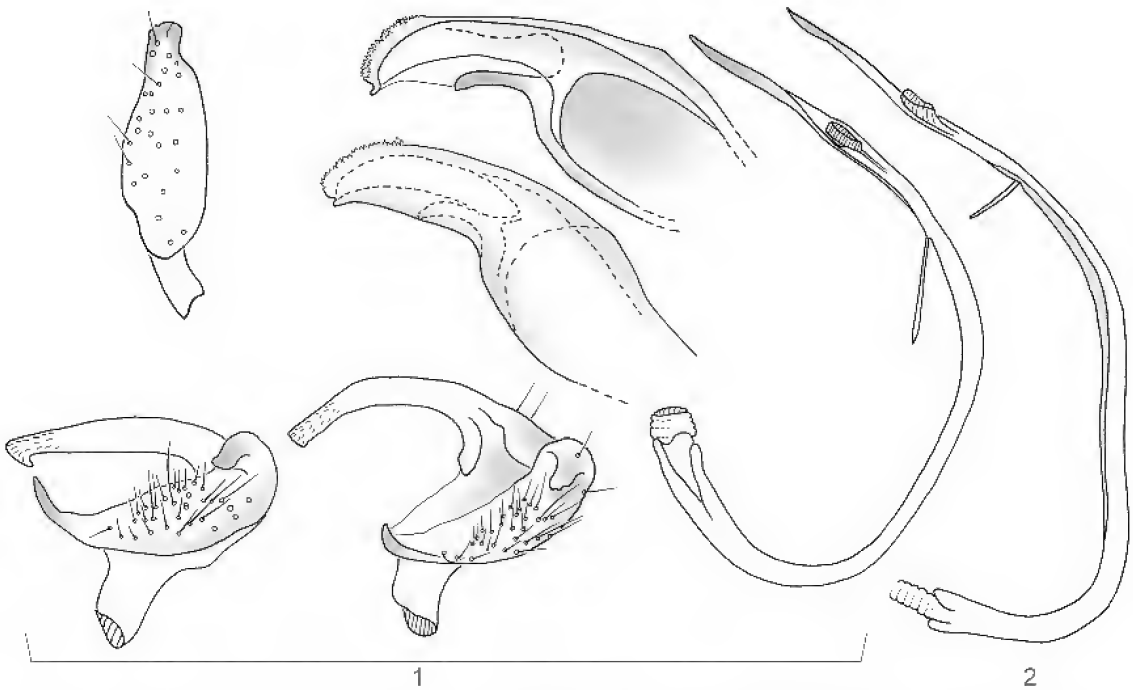


Fig. 31. *Phymatopsallus dubiosus:* Male genitalia (male 1, AMNH_PBI 00062339; male 2, 00074205).

DIAGNOSIS: Recognized among *Phymatopsallus* species with large eyes in the males by the structure of the male genitalia, the vesica more or less J-shaped, the shaft not noticeably twisted, the apex of vesica nearly straight, the medial spine very short, the insertion of the spine removed from secondary gonopore by a distance slightly less than the length of the spine (fig. 31). Total length 2.53–2.79, being much greater than that in *P. acaciae*, slightly greater than that in most specimens of *P. rinconae*, and of about equal length to that in *P. patagoniae* and *P. tuberculatus*. Short vesical spine most similar to that of *P. patagoniae*, but about one-third shorter than spine in that species and placed closer to the secondary gonopore, whereas the vesical spine in *P. rinconae* and *P. tuberculatus* nearly 3 times length of that in *P. dubiosus*.

REDESCRIPTION: *Male:* Small, total length 2.53–2.80, length apex clypeus–cuneal fracture 1.72–1.94, width pronotum 0.86–0.98. COLORATION (fig. 3): Pale green. SURFACE AND VESTITURE (figs. 3, 29C): As in generic description. STRUCTURE: Head: Frons barely protruding beyond anterior margin of eyes; eyes relatively large (fig. 3), ratio total width of head:width of vertex 0.67:0.30; labium relatively short, not quite reaching hindmargin of middle trochanters. GENITALIA (fig. 31): Vesica: J-shaped, not twisted, medial spine short, removed from secondary gonopore by about length of spine. Phallotheca: Thumblike process relatively slender and weakly curving. Parameres: Left paramere with projection on the dorsal margin relatively slender and rather strongly curving; right paramere distinctly narrowed and nearly parallel-sided on apical fourth, apical projections indistinct.

Female: Ovoid; total length 2.36–2.66, length apex clypeus–cuneal fracture 1.76–1.87, width pronotum 0.83–0.92. COLORATION (fig. 3): As in male. SURFACE AND VESTITURE: As in male. STRUCTURE: Eyes smaller in size than those of male. GENITALIA (genitalia examined; not illustrated): See generic description.

HOSTS: Recorded from *Haplopappus acradenius* (Greene) S.F. Blake (Asteraceae), *Tiquilia palmeri* (A. Gray) A.T. Richardson (Boraginaceae), and *Cercidium* sp. (Fabaceae). Additional collecting will be required

to ascertain whether *P. dubiosus* actually breeds on *Haplopappus* and *Tiquilia*.

DISTRIBUTION (map 6): Known from Pima and Yuma Counties in southwestern Arizona, and Imperial, Riverside, and Inyo Counties in California, the last representing the most northerly record for the taxon.

DISCUSSION: Van Duzee (1918) described *Tuponia dubiosa* on the basis of six female specimens (CAS) collected on palo verde (*Cercidium* sp.) (Fabaceae) at Coachella, California, in the northern part of the Coachella Valley; I have examined all of those specimens, including the holotype. Five of the specimens are completely yellowed and therefore the connection to *Phymatopsallus* is not immediately obvious. However, one of the paratypes retains its green coloration, helping to confirm its placement in *Phymatopsallus*. I am applying this name to other material collected in Imperial County, California. Because the description of this nominal taxon was based solely on females, and because I have not made a thoroughgoing study of the female genitalia at the species level, I am not positive of the identity of *Tuponia dubiosa* as construed by Van Duzee. Nonetheless, all other names pertaining to true *Phymatopsallus* spp. have been accounted for, and I therefore judge the use of *P. dubiosus* in the sense applied here to a species that is known from additional material from the Coachella and Imperial Valleys, to be superior to creating a new name for this taxon and treating *Tuponia dubiosa* as a nomen dubium.

HOLOTYPE: **USA: California:** ***Riverside Co.:*** Coachella [33.6803°N 116.17389°W], 16 May 1917, E.P. Van Duzee, 1♀ (AMNH_PBI 00077830) (CAS).

PARATYPES: **USA: Arizona:** ***Yuma Co.:*** Yuma County [32.72528°N 114.62361°W], 28 Apr 1929, L.L. Stitt, 3♀ (AMNH_PBI 00068640–AMNH_PBI 00068642) (USNM) (*P. prosopidis* Knight). **California:** ***Riverside Co.:*** Coachella, 33.6803°N 116.17389°W, 16 May 1917, E.P. Van Duzee, *Cercidium* sp. (Fabaceae), 4♀ (AMNH_PBI 00068639, AMNH_PBI 00077141–AMNH_PBI 00077143) (CAS).

OTHER SPECIMENS EXAMINED: **USA: Arizona:** ***Pima Co.:*** San Xavier Mission, Tucson, 32.1073°N 111.00731°W, 770 m, 29 Jul 1924, E.P. Van Duzee, 1♂ (AMNH_PBI 00068638) (CAS). **California:** ***Imperial Co.:*** 1 mi E of Coyote Wells, E of intersection of Rts S80 & I-8, 32.73861°N 115.94948°W, 23 Apr 1980, Schwartz and Russell, *Haplopappus acradenius* (Asteraceae), 13♂ (AMNH_PBI 00062334–AMNH_PBI 00062340, AMNH_PBI 00062342, AMNH_PBI 00062343, AMNH_PBI 00063110, AMNH_PBI 00063112, AMNH_PBI 00063114, AMNH_PBI 00063115), 4♀ (AMNH_PBI 00062341, AMNH_PBI 00062344, AMNH_PBI 00062345, AMNH_PBI 00063111) (AMNH). 5.4 mi NW of Ocotillo on Rt S2, 32.79381°N 116.05899°W, 23 Apr 1980, Schwartz and Russell, *Tiquilia palmeri* (Boraginaceae), 7♂ (AMNH_PBI 00062326–AMNH_PBI 00062332), 2♀ (AMNH_PBI 00062333, AMNH_PBI 00063133) (AMNH). ***Inyo Co.:*** Resting Springs, 35.87774°N 116.15807°W, 540 m, 29 May 1955, Belkin et al., 2♂ (AMNH_PBI 00074205, AMNH_PBI 00074206) (LACM).

Phymatopsallus patagoniae Knight
figures 3, 32; map 6

Phymatopsallus patagoniae Knight, 1964: 132 (n.sp.).

Phymatopsallus prosopidis Knight, 1968: 49 (n.sp.). NEW SYNONYMY.

Sonoraphylus hermosillensis Carvalho and Costa, 1992: 121 (n.sp.). NEW SYNONYMY.

DIAGNOSIS: Recognized among *Phymatopsallus* species with large eyes by the structure of the male genitalia, the vesica being more or less J-shaped, the vesical shaft at most barely twisted, the apex of vesica in most specimens nearly straight, sometimes weakly decurved, the medial spine of vesica of medium length, inserted relatively close to the secondary gonopore, that distance equal to about two-thirds the length of the spine (fig. 32). Total length 2.42–2.95, being greater than that in *P. acaciae* and *P. rinconae* and of about equal to that in *P. dubiosus* and *P. tuberculatus*. Most easily confused with *P. dubiosus* and *P. acaciae* on length of the vesical spine, but the spine in *P. patagoniae* about one-half longer than in *P. dubiosus* and not placed so near to gonopore; the vesical spine of about equal length to that in *P. acaciae* but placed much nearer to gonopore than spine in that species; the vesical spine in *P. patagoniae* approximately 0.55 times the length of spine in *P. rinconae* and *P. tuberculatus*.

REDESCRIPTION: *Male:* Small, total length 2.42–2.95, length apex clypeus–cuneal

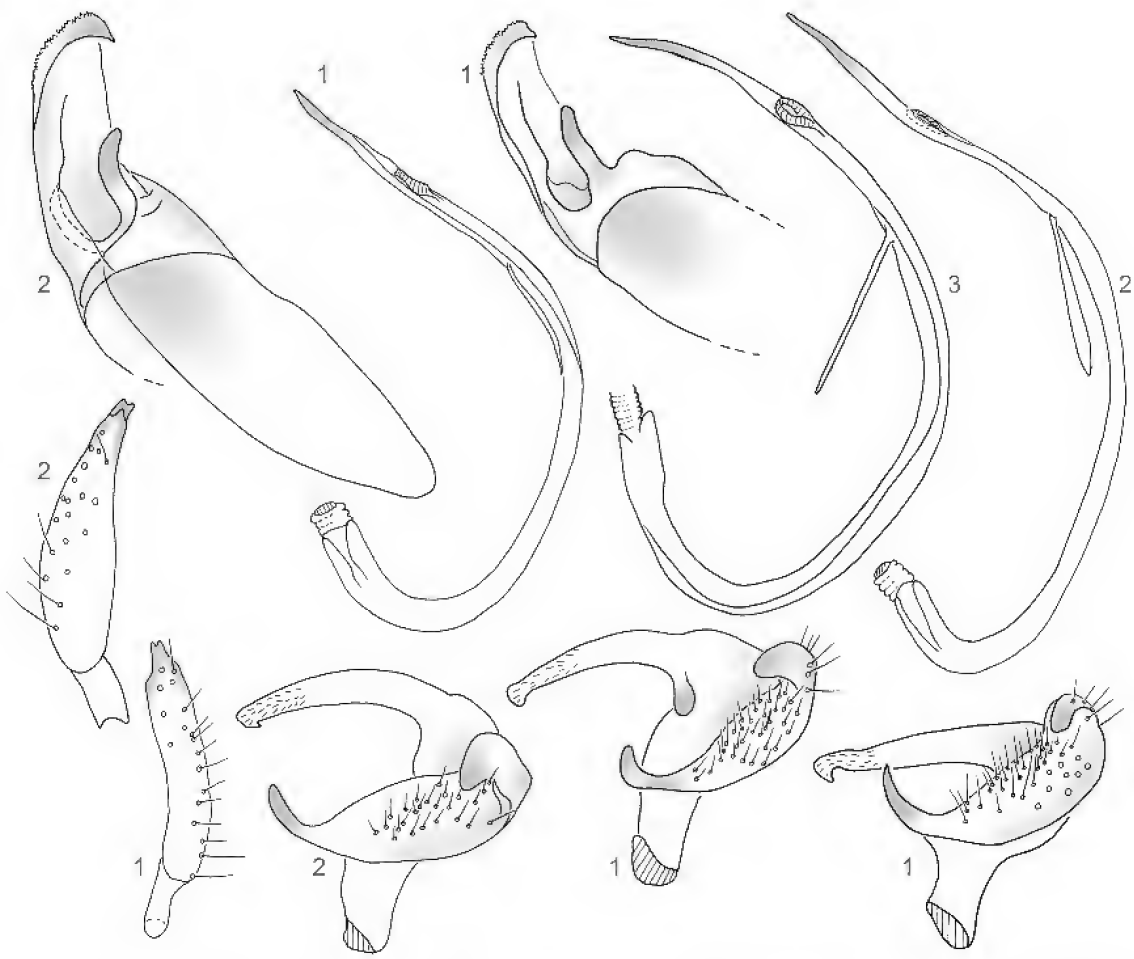


Fig. 32. *Phymatopsallus patagoniae:* Male genitalia (male 1, AMNH_PBI 00068597; male 2, 00068661; male 3, 00068652).

fracture 1.65–2.03, width pronotum 0.80–1.01. COLORATION (fig. 3): Pale green. SURFACE AND VESTITURE (figs. 3, 29C): As in generic description. STRUCTURE: Head: Frons barely protruding beyond anterior margin of eyes; eyes relatively large, ratio total width of head:width of vertex 66:33; labium reaching to hindmargin of hind trochanters. GENITALIA (figs. 32): Vesica: More or less J-shaped but shaft curving near insertion of medial spine; shaft at most barely twisted; apex of vesica in most specimens nearly straight, sometimes weakly decurved; medial spine on vesica of medium length, insertion relatively close to secondary gonopore, distance equal to about two-thirds length of spine. Phallotheca: Thumblike process ("spine") relatively slender and weakly curving. Parameres: Left paramere with projection on the dorsal margin moderately broad and curving; right paramere distinctly elongate and nearly parallel-sided or tapered toward apex, apical projections short but distinct.

Female: Ovoid; total length 2.42–3.30, length apex clypeus–cuneal fracture 1.73–2.30, width pronotum 0.85–0.99. COLORATION (fig. 3): As in male. SURFACE AND VESTITURE: As in male. STRUCTURE: Eyes smaller in size than those of male. GENITALIA (genitalia examined; not illustrated): See generic description.

HOST: Recorded from *Acacia constricta* Benth. ex A. Gray, *Prosopis juliflora* (Sw.) DC, and *Prosopis* sp. (Fabaceae).

DISTRIBUTION (map 6): Known from northern Sonora, Mexico, north through Arizona to the southernmost counties in Nevada and Utah.

DISCUSSION: *Phymatopsallus patagoniae* was described on the basis of two male specimens from Patagonia, Arizona. Dissection of the paratype (USNM) and comparison of that specimen with the holotype have been used to determine the structural attributes of this species.

Phymatopsallus prosopidis was described by Knight (1968) on the basis of specimens collected at the Nevada Test Site on *Prosopis juliflora*. A paratype male bearing the same label data as the holotype (USNM) was dissected to determine the identity of this nominal taxon. The male genitalic structure in *P. prosopidis* appears identical to that of *P. patagoniae*, and I am therefore treating these two nominal taxa as the same.

My construal of this taxon embraces some variation in the form of the vesical spine and the right paramere. Specimens from the type locality have the spine slender and weakly sinuous, whereas in specimens from Moctezuma, Sonora, Mexico, the spine is straight, and the spine in a single specimen from Patagonia in southern Arizona is weakly flattened. Other aspects of genitalic structure, including the form of the phallotheca and left paramere, show substantial similarity, which has caused me to recognize a single taxon of rather widespread distribution.

The tentative synonymy of *Sonoraphylus hermosillensis* Carvalho and Costa is based on illustrations associated with the original description of that taxon. After multiple requests, I was unable to secure a loan from the California Academy of Sciences of the male paratype on which Carvalho and Costa (1992) based their genitalic illustrations.

HOLOTYPES: **USA: Arizona: *Santa Cruz Co.:*** Patagonia [31.53944°N 110.75556°W], 4000 ft, 12 Jun 1928, A.A. Nichol, 1♂ (AMNH_PBI 00069800) (USNM) (*P. patagoniae*). **Nevada: *Nye Co.:*** Mercury, CM [36.66056°N 115.99361°W], 13 Jun 1965, D.E. Beck and H. Knight, 1♂ (AMNH_PBI 00069810) (USNM) (*P. prosopidis*).

PARATYPES: **USA: Arizona: *Santa Cruz Co.:*** Patagonia, 31.53944°N 110.75556°W, 4000 ft, 12 Jun 1928, A.A. Nichol, 1♂ (AMNH_PBI 00068661) (USNM) (*P. patagoniae*). **Nevada: *Nye Co.:*** Mercury, CM, 36.66056°N 115.99361°W, 13 Jun 1965, D.E. Beck and H. Knight, *Prosopis juliflora* (Fabaceae), 6♂ (AMNH_PBI 00068597, AMNH_PBI 00068598, AMNH_PBI 00068643–AMNH_PBI 00068646), 3♀ (AMNH_PBI 00068599, AMNH_PBI 00068647, AMNH_PBI 00068648) (USNM) (*P. prosopidis*).

OTHER SPECIMENS EXAMINED: **MEXICO: Sonora:** 40 mi W of Moctezuma, 29.81666°N 110.33316°W, 27 Apr 1981, D.A. and J.T. Polhemus, 7♂ (AMNH_PBI 00063423, AMNH_PBI 00063424, AMNH_PBI 00063462–AMNH_PBI 00063466), 13♀ (AMNH_PBI 00063425, AMNH_PBI 00063467–AMNH_PBI 00063478) (JTP). **USA: Arizona: *Cochise Co.:*** 8 mi E of Sierra Vista, Gray Hawk Ranch, 31.55436°N 110.16679°W, 1219 m, 05 Jun 1997, T.J. Henry and A.G. Wheeler, Jr., *Prosopis* sp. (Fabaceae), 1♂ (AMNH_PBI 00068655), 3♀ (AMNH_PBI 00068658–AMNH_PBI 00068660), Light Trap, 3♂ (AMNH_PBI 00068652–AMNH_PBI 00068654), 2♀ (AMNH_PBI 00068656, AMNH_PBI 00068657) (USNM). ***Maricopa Co.:*** Gila Bend, 32.94778°N 112.71611°W, 260 m, 07 May 1978, R.T. Schuh, 1♂ (AMNH_PBI 00062346) (AMNH). ***Pima Co.:*** Tucson, E. Saddleback Rd, 32.29731°N 110.8048°W, 800 m, 14 May 2000, M.D. Schwartz, *Acacia constricta* (Fabaceae), 9♂ (AMNH_PBI 00062347–AMNH_PBI 00062353, AMNH_PBI 00063153, AMNH_PBI 00063154), 22♀ (AMNH_PBI 00062354–AMNH_PBI 00062373, AMNH_PBI 00063151, AMNH_PBI 00063152) (AMNH). **Utah: *Washington Co.:*** Saint George, 37.10417°N 113.58333°W, 853 m, 30 Jun 1965, H.H. Knight, 4♀ (AMNH_PBI 00068600, AMNH_PBI 00068649–AMNH_PBI 00068651) (USNM).

Phymatopsallus rinconae Knight
figures 3, 33; map 6

Phymatopsallus rinconae Knight, 1964: 132 (n.sp.).

Phymatopsallus chiricahuae Knight, 1964: 132 (n.sp.). NEW SYONONYMY.

DIAGNOSIS: Recognized by the moderate size among *Phymatopsallus* spp. and relatively large eyes, but most reliably by the structure of the male genitalia: vesica in male with shaft noticeably twisted proximad of secondary gonopore; apex of vesica weakly

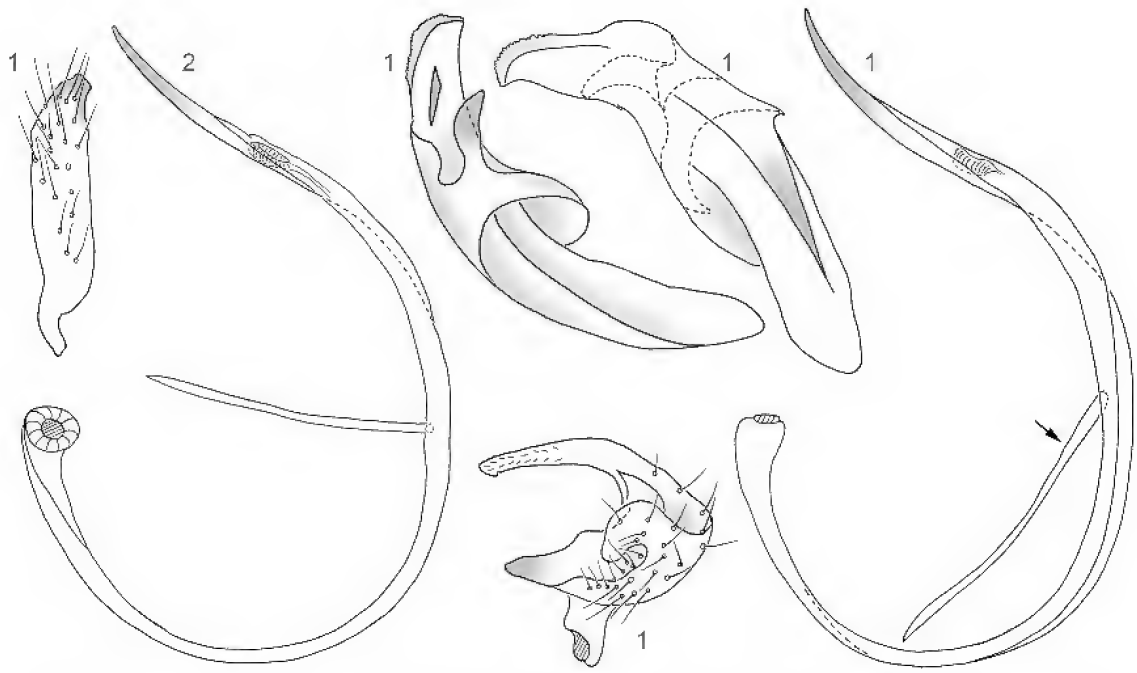


Fig. 33. *Phymatopsallus rinconae:* Male genitalia (male 1, AMNH_PBI 00063106; male 2, 00063104).

curving and distinctly tapered from secondary gonopore to tip; medial spine on vesica long, approximately one-third length of vesica, insertion removed from secondary gonopore by about 0.75 times length of spine (fig. 33). Total length ranging from 2.30 to 3.11, being greater than in *P. acaciae* and usually less than in *P. dubiosus*, *P. patagoniae*, and *P. tuberculatus*. The vesical spine most similar in length to that of *P. tuberculatus*, at least 50% longer than the spine in other known species, the insertion of spine being much farther removed from secondary gonopore than in *P. tuberculatus*, that species with spine inserted about 0.45–0.50 times length of spine from gonopore.

REDESCRIPTION: *Male:* Small, total length 2.30–3.11, length apex clypeus–cuneal fracture 1.56–2.00, width pronotum 0.79–1.00. COLORATION (fig. 3): Pale green. SURFACE AND VESTITURE (figs. 3, 29C): As in generic description. STRUCTURE: Head: Frons barely protruding beyond anterior margin of eyes; eyes relatively large, ratio total width of head:width of vertex 62:20; labium reaching to between middle and hind trochanters. GENITALIA (figs. 33): Vesica: Broadly curving; shaft distinctly twisted just proximad of secondary gonopore; apex of vesica in most specimens weakly curving and distinctly tapered from secondary gonopore to tip; medial spine on vesica long, insertion well removed from secondary gonopore by about 0.75 times length of spine. Phallotheca: Thumblike process ("spine") tapered toward apex. Parameres: Left paramere with projection on the dorsal margin broad, erect, and curving; right paramere distinctly elongate and nearly parallel-sided, apical projections weakly developed.

Female: Ovoid; total length 2.28–2.63, length apex clypeus–cuneal fracture 1.56–1.77, width pronotum 0.78–0.91. COLORATION (fig. 3): As in male. SURFACE AND VESTITURE: As in male. STRUCTURE: Eyes smaller in size than those of male. GENITALIA (genitalia examined; not illustrated): See generic description.

HOSTS: Van Duzee (1923) recorded this species as having been collected on mesquite (*Prosopis* spp.). More recent records document its occurrence on *Acacia* spp., *Cercidium floridum* Benth. ex A. Gray, *Prosopis glandulosa* Torr., *Prosopis* sp. (Fabaceae), *Bursera microphylla* A. Gray (Burseraceae),

Lycium sp. (Solanaceae), and *Rhus microphylla* Engelm. ex A. Gray (Anacardiaceae). The single record from *Euphorbia* sp. almost certainly represents a sitting record.

DISTRIBUTION (map 6): Known from the Big Bend region of West Texas, through southern Arizona to southern California, and south to Rosario in Baja California Sur, Mexico.

DISCUSSION: This species is most easily confused with *P. tuberculatus* on the basis of the male genitalia and particularly the length of the vesical spine. Nonetheless, the twisting of the vesica just proximad of the secondary gonopore in *P. rinconae* easily distinguishes most specimens of the two species. The vesical spine in *P. rinconae*, and also in *P. tuberculatus*, may be variously oriented relative to the vesica after dissection, although the normal position in repose appears to be with the spine pointed toward the base of the vesica.

Phymatopsallus rinconae is widely distributed and has a distribution broadly overlapping that of *P. tuberculatus* in Arizona, making recognition on the basis of distribution difficult, if not impossible. Recognition on the basis of host association is also unreliable. The identity of *P. rinconae* has been fixed through the dissection of a male paratype (USNM) from the type locality and comparison of that specimen with the undissected holotype male.

Knight (1964) indicated that his new species *Phymatopsallus chiricahuae* was known from only a single specimen, which he had dissected and which was in the process "badly damaged", with the genitalia glued on a card. He noted in the description that the "Genital segment with tubercle and claspers distinctive of the species". His illustrations (Knight, 1964: fig. 14) confirm that he was indeed describing a *Phymatopsallus* sp. because of the presence of the fingerlike process on the anterodorsal margin of the left paramere. However, the male specimen labeled as the holotype of *Phymatopsallus chiricahuae* is not dissected and is not a *Phymatopsallus* sp., and it lacks the tubercle on the pygophore as well as the fingerlike process on the left paramere.

Apparently Knight had a change of mind after preparing his description, because the specimen he referred to as the holotype is now part of a series of three male and one female specimens in the collections of the USNM, each of which bears a label in Knight's handwriting reading "Autotype *Phymatopsallus chiricahuae* by H.H. Knight". I soaked the genitalia off the card and determined that the specimen designated as the holotype of *Phymatopsallus chiricahuae* by Knight in his 1964 publication is actually conspecific with *Phymatopsallus rinconae* Knight, a conclusion based on the presence of a long medial vesical spine inserted a substantial distance from the secondary gonopore. I am treating *P. chiricahuae* as the junior synonym. I have attached an additional label to this specimen reading "HOLOTYPE *Phymatopsallus chiricahuae* Knight, det. R.T. Schuh". I have further placed the genitalia of this specimen in a microvial that is attached to the pin. (See also discussion under *Knightopsallus portalensis*.)

HOLOTYPES: **USA: Arizona:** ***Cochise Co.:*** Chiricahua Mountains [31.59222°N 109.24°W], 6200 ft, 20 Jun 1928, A.A. Nichol, 1♂ (AMNH_PBI 00068593) (USNM) (*P. chiricahuae*). ***Pima Co.:*** Rincon Mountains [32.07611°N 111.91722°W], alt 3300, 27 May 1928, A.A. Nichol, 1♂ (AMNH_PBI 00069809) (USNM) (*P. rinconae*).

PARATYPES: **USA: Arizona:** ***Cochise Co.:*** Texas Pass [Summit], 32.06314°N 110.07479°W, 1523 m, 20 Jul 1917, H.H. Knight, 13♂ (AMNH_PBI 00068725–AMNH_PBI 00068737), 14♀ (AMNH_PBI 00068738–AMNH_PBI 00068751) (USNM) (*P. strombocarpae*). ***Pima Co.:*** Rincon Mountains, 32.07611°N 111.91722°W, 1006 m, 27 May 1928, A.A. Nichol, 3♂ (AMNH_PBI 00068601, AMNH_PBI 00068602, AMNH_PBI 00068713), 3♀ (AMNH_PBI 00068603, AMNH_PBI 00068714, AMNH_PBI 00068715) (USNM) (*P. rinconae*). Tucson, 32.22167°N 110.92583°W, 07 Jun 1924, A.A. Nichol, 1♂ (AMNH_PBI 00068716) (USNM) (*P. nicholi*).

OTHER SPECIMENS EXAMINED: **MEXICO: Baja California Sur:** 1.2 rd. mi E of Rosario, 26.45°N 111.63333°W, 05 Sep 1988, E. G. Riley, 1♂ (AMNH_PBI 00056047) (TAMU). **Chihuahua:** Chihuahua, 28.63333°N 106.08333°W, 1402 m, 29 May 1964, L. A. Kelton, *Acacia* sp. (Fabaceae), 7♂ (AMNH_PBI 00123261-AMNH_PBI 00123267), 7♀ (AMNH_PBI 00123268-AMNH_PBI 00123274) (CNC). **USA: Arizona:** ***Cochise Co.:*** 0.5 mi E of Portal, 31.91361°N

109.13231°W, 1450 m, 12 Jun 1980, R.T. Schuh, K. and R. Schmidt, *Lycium* sp. (Solanaceae), 5♂ (AMNH_PBI 00062042, AMNH_PBI 00062043, AMNH_PBI 00062538, AMNH_PBI 00062539, AMNH_PBI 00063109), 24♀ (AMNH_PBI 00096968–AMNH_PBI 00096972, AMNH_PBI 00097011–AMNH_PBI 00097020, AMNH_PBI 00097050–AMNH_PBI 00097058) (AMNH); 13 Jun 1980, R.T. Schuh, K. and R. Schmidt, *Acacia greggii* (Fabaceae), det. B. Ertter, 1980 NYBG, 1♂ (AMNH_PBI 00096975), 17♀ (AMNH_PBI 00096994–AMNH_PBI 00097010) (AMNH). Huachuca Mountains, Miller Canyon, 31.48889°N 110.4075°W, 02 Jun 1997, T.J. Henry and A.G Wheeler, Jr., *Prosopis* sp. (Fabaceae), 3♂ (AMNH_PBI 00068717–AMNH_PBI 00068719), 5♀ (AMNH_PBI 00068720–AMNH_PBI 00068724) (USNM). Portal, 31.91361°N 109.14083°W, 1500 m, 15 Jun 1980, R.T. Schuh and K. Schmidt, 42♂ (AMNH_PBI 00062107–AMNH_PBI 00062139, AMNH_PBI 00062245–AMNH_PBI 00062253) (AMNH); 15 Jun 1980, R.T. Schuh, K. and R. Schmidt, 77♂ (AMNH_PBI 00062003–AMNH_PBI 00062018, AMNH_PBI 00063108, AMNH_PBI 00063128, AMNH_PBI 00097059–AMNH_PBI 00097117), 2♀ (AMNH_PBI 00062019, AMNH_PBI 00063119) (AMNH). SWRS, 5 mi SW of Portal, 31.88333°N 109.20611°W, 1646 m, 21 Aug 1982, M.A. Cazier, 1♂ (AMNH_PBI 00062045) (AMNH). ***Gila Co.:*** 3 mi S of Salt River Bridge on Rt 77, 33.39416°N 110.78638°W, 1074 m, 20 Jun 1980, K. and R. Schmidt, *Circidium* sp. (Fabaceae), 3♂ (AMNH_PBI 00061985, AMNH_PBI 00061986, AMNH_PBI 00063103), 18♀ (AMNH_PBI 00061987–AMNH_PBI 00062002, AMNH_PBI 00063121, AMNH_PBI 00063122) (AMNH). 5.5 mi W of Roosevelt Dam, at Apache Lake, 33.6675°N 111.22914°W, 533 m, 27 May 1983, Schuh, Stonedahl, and Massie, 4♂ (AMNH_PBI 00062174–AMNH_PBI 00062177), 12♀ (AMNH_PBI 00062178–AMNH_PBI 00062189) *Rhus microphylla* Engelm. (Anacardiaceae), 4♂ (AMNH_PBI 00062254–AMNH_PBI 00062257), 13♀ (AMNH_PBI 00062232–AMNH_PBI 00062244) *Circidium floridum* (Fabaceae), 2♂ (AMNH_PBI 00062033, AMNH_PBI 00062034), 7♀ (AMNH_PBI 00062035–AMNH_PBI 00062041) (AMNH). ***Graham Co.:*** 3 mi W of Rt 666 on Rt 266, 32.58086°N 109.71094°W, 1219 m, 02 Jun 1983, R.T. Schuh, G.M. Stonedahl, *Acacia greggii* A. Gray (Fabaceae), 14♂ (AMNH_PBI 00062020, AMNH_PBI 00062021, AMNH_PBI 00062083–AMNH_PBI 00062094), 13♀ (AMNH_PBI 00062095–AMNH_PBI 00062106, AMNH_PBI 00063120) (AMNH). Stockton Pass, Pinaleno Mountains, 32.64083°N 109.84306°W, 1631 m, 01 Jun 1983, R.T. Schuh and G.M. Stonedahl, 5♂ (AMNH_PBI 00062141–AMNH_PBI 00062144, AMNH_PBI 00063105), 5♀ (AMNH_PBI 00062145–AMNH_PBI 00062148, AMNH_PBI 00063125), 1♂ (AMNH_PBI 00062044) (AMNH). ***Maricopa Co.:*** 24 mi E of Gila Bend, Freeman, 32.94778°N 112.30265°W, 530 m, 08 May 1978, R.T. Schuh and A.F. Guenther, *Acacia* sp. (Fabaceae), 9♂ (AMNH_PBI 00062214–AMNH_PBI 00062221, AMNH_PBI 00096976), 28♀ (AMNH_PBI 00058612–AMNH_PBI 00058630, AMNH_PBI 00062222–AMNH_PBI 00062228, AMNH_PBI 00063123, AMNH_PBI 00063124) *Circidium* sp. (Fabaceae), 8♂ (AMNH_PBI 00062022–AMNH_PBI 00062029), 3♀ (AMNH_PBI 00062030–AMNH_PBI 00062032) (AMNH). ***Pima Co.:*** 7.5 mi S of Coronado Natl. Forest boundary on Mount Lemmon Rd, 32.31°N 110.72°W, 1433 m, 11 Jun 1983, Schuh, Schwartz, and Stonedahl, 15♂ (AMNH_PBI 00062149–AMNH_PBI 00062163), 10♀ (AMNH_PBI 00062164–AMNH_PBI 00062173) (AMNH). Santa Catalina Mountains, Molino Basin, 32.5°N 110.92056°W, 02 Aug 1970, J. Powell and P. Rude, 2♂ (AMNH_PBI 00079117, AMNH_PBI 00079119) (UCB). Tucson (NE), trail to Lower Bear Canyon Picnic Area, 32.36°N 110.7°W, 762 m, 27 Sep 1988, M.D. Schwartz, *Circidium* sp. (Fabaceae), 3♂ (AMNH_PBI 00071899–AMNH_PBI 00071901), 9♀ (AMNH_PBI 00071917-AMNH_PBI 00071925) (CNC). Tucson, Greasewood Park, 32.22167°N 110.92583°W, 13 Apr 1989, T.J. Henry and A.G. Wheeler, Jr., *Acacia* sp. (Fabaceae), 9♂ (AMNH_PBI 00068752–AMNH_PBI 00068760), 16♀ (AMNH_PBI 00068761–AMNH_PBI 00068776) (USNM). ***Pinal Co.:*** 5 mi S of San Manuel, T10S R17E, 32.52743°N 110.63028°W, 975 m, 12 Jun 1983, R.T. Schuh and M. D. Schwartz, 18♂ (AMNH_PBI 00062050–AMNH_PBI 00062066, AMNH_PBI 00063107), 17♀ (AMNH_PBI 00062067–AMNH_PBI 00062082, AMNH_PBI 00063127) (AMNH). ***Santa Cruz Co.:*** Madera Canyon, Santa Rita Mountains, 31.725°N 110.87944°W, 26 Aug 1965, C. Slobodchikoff, 1♂ (AMNH_PBI 00079118) (UCB). ***Yavapai Co.:*** Cottonwood, 36.07306°N 109.89167°W, 13 Aug 1975, J.C. Schaffner, 2♂ (AMNH_PBI 00056044, AMNH_PBI 00056048) (TAMU). ***Yuma Co.:*** Roll, 32.7517°N 113.989°W, 80 m, 01 May 1940, L.L. Stitt, 3♂ (AMNH_PBI 00070136-AMNH_PBI 00070138) (USNM). **California:** ***Orange Co.:*** Irvine Lake, 33.78502°N 117.72421°W, 240 m, 11 Sep 1963, M.E. Irwin, *Euphorbia* sp. (Euphorbiaceae), 1♂ (AMNH_PBI 00082313) (UCR). ***Riverside Co.:*** 5 mi S of Palm Springs, Palm Canyon, 33.75799°N 116.54444°W, 08 Jun 1978–05 Jul 1978, J.D. Pinto, 2♂ (AMNH_PBI 00082312, AMNH_PBI 00082315)

(UCR). Andreas Canyon, Palm Springs, 33.76222°N 116.53611°W, 10 May 1941, Timberlake, *Prosopis glandulosa* (Fabaceae), 1♂ (AMNH_PBI 00082323) (UCR). Desert Center, 33.71252°N 115.4022°W, 275 m, 02 May 1955, W.R.M. Mason, *Circidium* sp. (Fabaceae), 8♂ (AMNH_PBI 00123276–AMNH_PBI 00123283), 4♀ (AMNH_PBI 00123284–AMNH_PBI 00123287) (CNC). Indio, 33.72056°N 116.21472°W, 05 Aug 1935, R.H. Beamer, 1♂ (AMNH_PBI 00074865) (KU); 30 Apr 1955, W.R.M. Mason, *Circidium floridum* (Fabaceae), 1♂ (AMNH_PBI 00123275) (CNC). Palm Springs, 33.83028°N 116.54444°W, 10 May 1941, Timberlake, *Acacia greggii* (Fabaceae), 5♂ (AMNH_PBI 00082317–AMNH_PBI 00082321), 6♀ (AMNH_PBI 00082325–AMNH_PBI 00082330) (UCR). ***San Bernardino Co.:*** Morongo Valley, 34.04696°N 116.58084°W, 783 m, 27 Jul 1941, Timberlake, *Acacia greggii* (Fabaceae), 2♂ (AMNH_PBI 00082316, AMNH_PBI 00082322) (UCR). ***San Diego Co.:*** Anza-Borrego Desert State Park, Carrizo Creek, 10.2 mi NW of Ocotillo on Rt S2, 32.87°N 116.1°W,23 Apr 1980, M.D. Schwartz and L. Russell, *Acacia greggii* A. Gray (Fabaceae), 7♂ (AMNH_PBI 00062190–AMNH_PBI 00062195, AMNH_PBI 00063104), 5♀ (AMNH_PBI 00062196–AMNH_PBI 00062200) (AMNH). Anza-Borrego Desert State Park, Elephant Tree Trail, 33.05832°N 116.13287°W, 22 Apr 1980, M.D. Schwartz and L. Russell, *Bursera microphylla* Gray (Burseraceae), 4♂ (AMNH_PBI 00062530–AMNH_PBI 00062533), 3♀ (AMNH_PBI 00062534–AMNH_PBI 00062536) (AMNH). **Texas:** ***Brewster Co.:*** 5 mi N of Big Bend National Park on Rt 385, 29.75471°N 103.15881°W, 26 Apr 1978, T.J. Henry and R.T. Schuh, *Acacia rigidula* (Fabaceae), 5♂ (AMNH_PBI 00062201–AMNH_PBI 00062204, AMNH_PBI 00063106), 10♀ (AMNH_PBI 00062205–AMNH_PBI 00062213, AMNH_PBI 00063126) (AMNH). 5 mi N of Study Butte, Rt 118, 29.39568°N 103.51699°W, 26 Apr 1978, R.T. Schuh and T.J. Henry, 1♂ (AMNH_PBI 00062537) (AMNH). ***Jeff Davis Co.:*** Fort Davis, 30.58806°N 103.89417°W, 18 Aug 1965, J.C. Schaffner, 2♂ (AMNH_PBI 00056045, AMNH_PBI 00056046) (TAMU). ***Presidio Co.:*** Big Bend Ranch St. Nat. Area, 29.5125°N 103.86555°W, 14 May 1990, Judd, Wharton, Zolnerowich, 3♂ (AMNH_PBI 00056049, AMNH_PBI 00056050, AMNH_PBI 00092386), 7♀ (AMNH_PBI 00056051, AMNH_PBI 00056056, AMNH_PBI 00056172) (TAMU).

Phymatopsallus tuberculatus (Van Duzee)
figures 3, 34; map 7

Psallus tuberculatus Van Duzee, 1923: 161 (n.sp.).

Phymatopsallus strombocarpae Knight, 1964: 130 (n.sp.). NEW SYNONYMY.

Phymatopsallus nicholi Knight, 1964: 130 (n.sp.). NEW SYNONYMY.

Phymatopsallus viridescens Knight, 1964: 133 (n.sp.). NEW SYNONYMY.

DIAGNOSIS: Recognized among relatively large *Phymatopsallus* species by the structure of the male genitalia, the vesica being J-shaped, the shaft not noticeably twisted, the apex of vesica nearly straight, the medial vesical spine long (approximately one-third length of vesica), the insertion of the spine relatively close to the secondary gonopore, distance from the gonopore 0.45–0.50 times length of the spine (fig. 34). Total length ranging from 2.56 to 2.96, always being greater than length in *P. acaciae*, greater than most specimens of *P. rinconae*, and of about equal length to *P. dubiosus* and *P. patagoniae*. The long vesical spine most similar to that of *P. rinconae*, longer than the spine in other known species; insertion of the spine much closer to the secondary gonopore than in *P. rinconae*, that species with spine inserted at a distance from gonopore equal to about 0.75 times length of spine.

REDESCRIPTION: *Male:* Moderately small, total length 2.56–2.96, length apex clypeus–cuneal fracture 1.77–1.94, width pronotum 0.82–0.98. COLORATION (fig. 3): Pale green. SURFACE AND VESTITURE (figs. 3, 29C): As in generic description. STRUCTURE: Head: Frons barely protruding beyond anterior margin of eyes; eyes relatively large, ratio total width of head:width of vertex 64:30; labium slightly surpassing hindmargin of middle trochanters. GENITALIA (figs. 34): Vesica: Roughly J-shaped; shaft not noticeably twisted; apex of vesica nearly straight; medial spine on vesica long, approximately one-third length of vesica, insertion relatively close to secondary gonopore, distance from gonopore 0.45–0.50 times length of spine. Phallotheca: Thumblike process ("spine") on phallotheca nearly parallel-sided, with serrate dorsal margin. Parameres: Left paramere with projection on the dorsal margin broad, erect, and curving; right paramere somewhat squatty, lacking distinct projections apically.

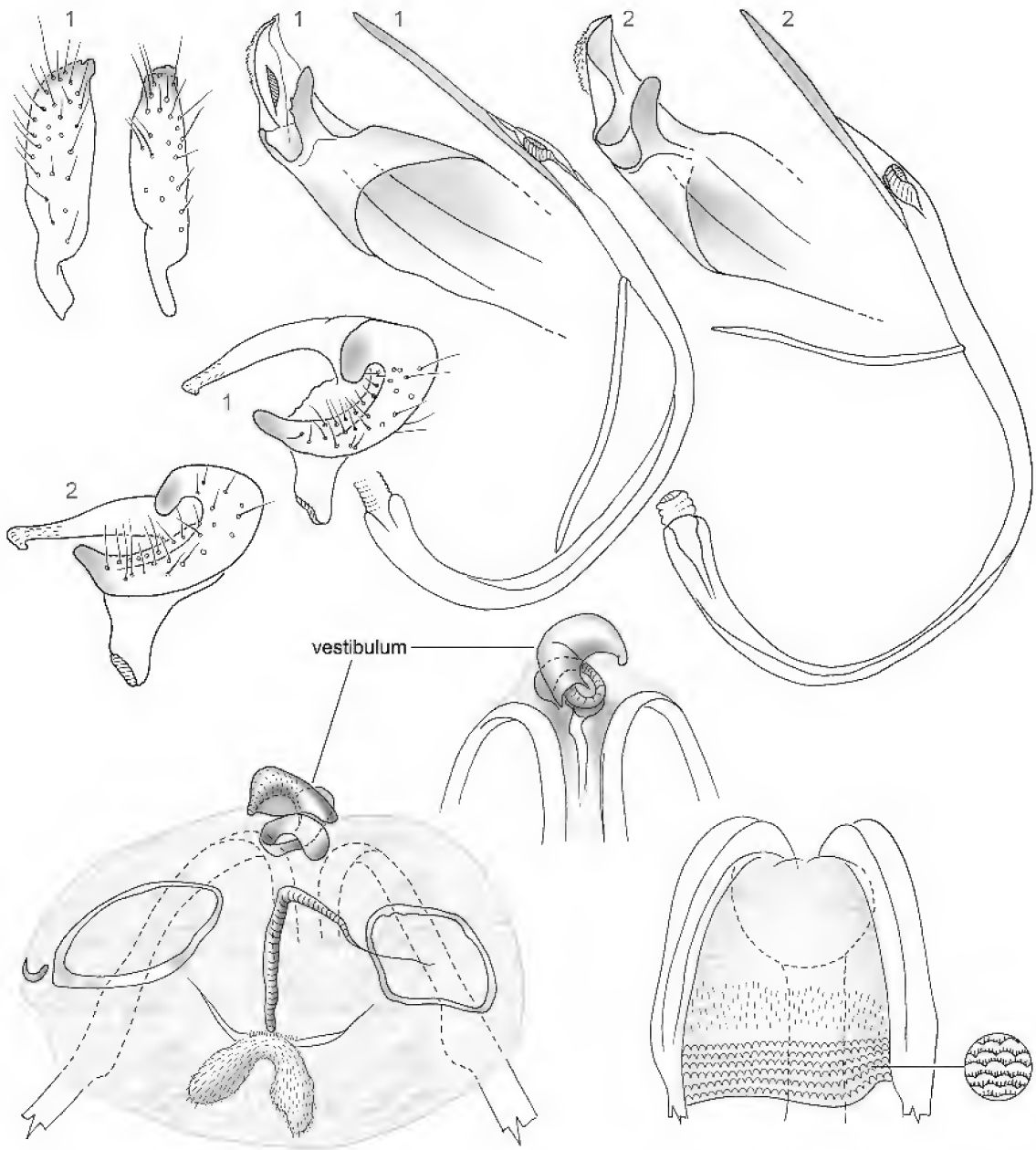


Fig. 34. *Phymatopsallus tuberculatus:* Male genitalia (male 1, AMNH_PBI 00062428; male 2, 00071893); female genitalia (AMNH_PBI 00062458).

Female: Ovoid; total length 2.30–2.72, length apex clypeus–cuneal fracture 1.56–1.90, width pronotum 0.78–0.97. COLORATION (fig. 3): As in male. SURFACE AND VESTITURE: As in male. STRUCTURE: Eyes smaller in size than those of male. GENITALIA (fig. 34): See generic description.

HOSTS: Known from *Prosopis glandulosa* Torr., *Prosopis juliflora* (Swartz) DC, *Prosopis* sp., *Acacia greggii*, and *Acacia* sp.

(Fabaceae). Van Duzee (1923) recorded this species from mesquite (*Prosopis* sp.).

DISTRIBUTION (map 7): Ranging from the Big Bend Region of west Texas northwest to the southernmost counties of Utah and Nevada, west to Inyo and more southerly counties in California, and south through much of Baja California and the north-central mainland of Mexico.

DISCUSSION: Examination of the holotype male (CAS) with its extruded vesica has fixed the identity of this species. The apex of the vesica is nearly straight and the vesical spine is long and placed medially, allowing for unequivocal use of the name *tuberculatus* for this commonly collected and widespread species.

The synonymy of *Phymatopsallus strombocarpae* Knight is based on the examination of male genitalia of dissected and undissected specimens, the latter with the vesica protruded, from the type locality, Fabens, Texas, and comparison of these specimens with the undissected holotype male (USNM). These specimens are all labeled as having been collected on *Strombocarpa pubescens*.

The synonymy of *Phymatopsallus nicholi* Knight is based on the examination of male genitalia from a dissected male paratype (CNC) from the Santa Catalina Mountains, Arizona, with the same label data as the holotype, and comparison of the undissected holotype male (USNM) with that specimen. Dissection of specimens from Texas Pass [Summit], Arizona, designated by Knight (1964) as paratypes of *P. nicholi*, indicates that these specimens are conspecific with *Phymatopsallus rinconae* Knight.

Phymatopsallus viridescens was described by Knight (1964) on the basis of a single male specimen from Death Valley, California (USNM). Dissection of the genitalia of the holotype indicates that this nominal taxon is a junior synonym of *P. tuberculatus*, based on the length and position of the vesical spine and the structure of the apex of the vesica.

HOLOTYPES: **MEXICO: Baja California Sur:** San Nicolas Bay, Gulf of California [26.50472°N 111.48°W], 16 May 1921, E.P. Van Duzee, 1♂ (AMNH_PBI 00077828) (CAS) (*P. tuberculatus*). **USA: Arizona: *Pima Co.:*** Santa Catalina Mountains [32.5°N 110.92056°W, 823 m], 04 May 1928, A.A. Nichol, 1♂ (AMNH_PBI 00069807) (USNM) (*P. nicholi*). **California: *Inyo Co.:*** Death Valley [36.45556°N 116.86667°W], 01 Apr 1936, E.L. Paddock, 1♂ (AMNH_PBI 00069806) (USNM) (*P. viridescens*). **Texas: *El Paso Co.:*** Fabens [31.49595°N 106.14803°W, 1103 m], 09 Jul 1917, H.H. Knight, *Strombocarpa pubescens*, 1♂ (AMNH_PBI 00069804) (USNM) (*P. strombocarpae*).

PARATYPES: **MEXICO: Baja California Sur:** Carmen Island, Gulf of California, Porto Ballandra, 26.00666°N 111.15111°W, 22 May 1921, E.P. Van Duzee, 1♂ (AMNH_PBI 00077149) (CAS) (*P. tuberculatus*). San Nicolas Bay, Gulf of California, 26.50472°N 111.48°W, 16 May 1921, E.P. Van Duzee, *Prosopis* sp. (Fabaceae), 2♂ (AMNH_PBI 00068783, AMNH_PBI 00077119) (USNM) (*P. tuberculatus*). **USA: Arizona: *Cochise Co.:*** Bowie, 32.3264°N 109.487°W, 1147 m, 15 Jul 1917, H.H. Knight, 5♂ (AMNH_PBI 00070144–AMNH_PBI 00070148), 3♀ (AMNH_PBI 00070149–AMNH_PBI 00070151) (USNM) (*P. strombocarpae*). ***Pima Co.:*** Santa Catalina Mountains, 32.5°N 110.92056°W, 823 m, 04 May 1928, A.A. Nichol, 1♂ (AMNH_PBI 00071893), 1♀ (AMNH_PBI 00071894) (CNC); 05 Aug 1924–25 Sep 1924, A. A. Nichol, 3♂ (AMNH_PBI 00068698–AMNH_PBI 00068700) (USNM); 15 Jul 1924, A.A. Nichol, 6♀ (AMNH_PBI 00068704–AMNH_PBI 00068709) (USNM) (*P. acaciae*). The Alamo, Ajo Mountains, 27 Apr 1939, A.A. Nichol, 3♂ (AMNH_PBI 00070152–AMNH_PBI 00070154), 4♀ (AMNH_PBI 00070155–AMNH_PBI 00070158) (USNM) (*P. strombocarpae*). Tucson, 32.22167°N 110.92583°W, 732 m, 22 Jul 1917, H.H. Knight, 4♂ (AMNH_PBI 00070159–AMNH_PBI 00070162) (USNM) (*P. nicholi*); 25 Jul 1925, R.B. Streets, 2♂ (AMNH_PBI 00070163, AMNH_PBI 00070164) (USNM) (*P. nicholi*). Tucson, 32.22167°N 110.92583°W, 07 Jun 1924, A.A. Nichol, 1♂ (AMNH_PBI 00071895), 1♀ (AMNH_PBI 00071896) (CNC) (*P. acaciae*). *Acacia greggii* (Fabaceae), 5♂ (AMNH_PBI 00068605, AMNH_PBI 00068606, AMNH_PBI 00068695–AMNH_PBI 00068697), 3♀ (AMNH_PBI 00068710–AMNH_PBI 00068712) (USNM) (*P. acaciae*). **New Mexico: *Hidalgo Co.:*** Steins, 32.22925°N 108.9895°W, 1324 m, 14 Jul 1917, H.H. Knight, *Acacia greggii* (Fabaceae), 3♀ (AMNH_PBI 00068701–AMNH_PBI 00068703) (USNM) (*P. acaciae*). **Texas: *El Paso Co.:*** Fabens, 31.49595°N 106.14803°W, 1103 m, 09 Jul 1917, H.H. Knight, 2♂ (AMNH_PBI 00071897, AMNH_PBI 00071898) (CNC) (*P. strombocarpae*). *Strombocarpa pubescens* (Fabaceae), 14♂ (AMNH_PBI 00068604, AMNH_PBI 00068662–AMNH_PBI 00068674), 15♀ (AMNH_PBI 00068607,

AMNH_PBI 00068679–AMNH_PBI 00068692) (USNM) (*P. strombocarpae*). ***Presidio Co.:*** Presidio, 29.56056°N 104.37167°W, 28 Sep 1929, W.L. Owens, 4♀ (AMNH_PBI 00068675–AMNH_PBI 00068678) (USNM) (*P. strombocarpae*).

OTHER SPECIMENS EXAMINED: **MEXICO: Baja California Norte:** 12 mi S of Palacio, 01 May 1939, A.C. Michener, 1♂ (AMNH_PBI 00077154) (CAS). 30 mi S of Mexicali, 32.19798°N 115.43333°W, 03 Apr 1961, H.F. Howden, 1♂ (AMNH_PBI 00072091) (CNC). 51 km W of Bahia de los Angeles, 28.94°N 114.07°W, 470 m, 23 Apr 1985, R.T. Schuh and B.M. Massie, *Prosopis glandulosa* (Fabaceae), 7♂ (AMNH_PBI 00062423–AMNH_PBI 00062428, AMNH_PBI 00063116), 11♀ (AMNH_PBI 00062429–AMNH_PBI 00062438, AMNH_PBI 00063135) (AMNH). **Baja California Sur:** 2.6 mi E of San Antonio, 25.34716°N 111.07066°W, 30 Jul 1971, H.G. Real and R.E. Main, 1♂ (AMNH_PBI 00077148) (CAS). 3 mi N of San Jose Viejo, 26.4267°N 112.15°W, 16 Jul 1971, H.G. Real and R.E. Main, 1♂ (AMNH_PBI 00077147) (CAS). Aqua Verde, 25.49833°N 111.05638°W, 26 May 1921, E.P. Van Duzee, 1♂ (AMNH_PBI 00077146) (CAS). El Sargento, 24.07806°N 109.99972°W, 29 Jul 1971, H.G. Real and R.E. Main, 2♂ (AMNH_PBI 00077155, AMNH_PBI 00077156), 1♂ (AMNH_PBI 00077144) (CAS). **Durango:** Durango, 24.0333°N 104.6667°W, 03 May 1961, Howden and Martin, 5♂ (AMNH_PBI 00072086–AMNH_PBI 00072090) (CNC). **Puebla:** 5 km SW of Zapotitlan, 19.96808°N 97.78397°W, 08 Jul 1973, Mastro and Schaffner, 3♂ (AMNH_PBI 00056061–AMNH_PBI 00056063) (TAMU). **Sonora:** 6 mi S of Presa Obregon, 27.72953°N 109.91666°W, 23 Mar 1980, J.T. Doyen, 1♂ (AMNH_PBI 00079777) (UCB). **USA: Arizona:** ***Cochise Co.:*** Portal, 31.91361°N 109.14083°W, 1500 m, 29 Jul 1967, L.A. Kelton, *Acacia* sp. (Fabaceae), 10♂ (AMNH_PBI 00071926–AMNH_PBI 00071935), 10♀ (AMNH_PBI 00071936–AMNH_PBI 00071945) (CNC); 15 Jun 1980, R.T. Schuh and K. Schmidt, 1♂ (AMNH_PBI 00062375) (AMNH); 27 Jul 1976, J.D. Pinto, *Prosopis* sp. (Fabaceae), 2♂ (AMNH_PBI 00082308, AMNH_PBI 00082310) (UCR). SWRS, 5 mi SW of Portal, 31.88333°N 109.20611°W, 1646 m, 26 Jun 1982, M. Cazier, 1♂ (AMNH_PBI 00058503) (AMNH). ***Gila Co.:*** 3 mi S of Salt River Bridge on Rt 77, 33.39416°N 110.78638°W, 1074 m, 20 Jun 1980, K. and R. Schmidt, *Prosopis* sp. (Fabaceae), 4♂ (AMNH_PBI 00062477–AMNH_PBI 00062480), 11♀ (AMNH_PBI 00062481–AMNH_PBI 00062491) (AMNH). 5.5 mi W of Roosevelt Dam, at Apache Lake, 33.6675°N 111.22914°W, 533 m, 27 May 1983, Schuh, Stonedahl, and Massie, *Prosopis juliflora* (Fabaceae), 5♂ (AMNH_PBI 00062374, AMNH_PBI 00062520–AMNH_PBI 00062523), 6♀ (AMNH_PBI 00062524–AMNH_PBI 00062529) (AMNH). ***Graham Co.:*** Fort Grant, 32.62285°N 109.94591°W, 1473 m, 15 Jul 1917–19 Jul 1917, Cornell Univ. Biological Expedition, 9♂ (AMNH_PBI 00076896–AMNH_PBI 00076904), 17♀ (AMNH_PBI 00076905–AMNH_PBI 00076921) (CU). Pinaleno Mountains, Stockton Pass, 32.64083°N 109.84306°W, 1631 m, 01 Jun 1982, R.T. Schuh and G.M. Stonedahl, 1♂ (AMNH_PBI 00096973) (AMNH). ***La Paz Co.:*** Bouse, 33.93252°N 114.00577°W, 290 m, 01 May 1991, J.G. Rozen, *Prosopis* sp. (Fabaceae), 1♂ (AMNH_PBI 00096974) (AMNH). ***Maricopa Co.:*** 24 mi E of Gila Bend, Freeman, 32.94778°N 112.30265°W, 530 m, 08 May 1978, R.T. Schuh and A.F. Guenther, *Prosopis* sp. (Fabaceae), 9♂ (AMNH_PBI 00062492–AMNH_PBI 00062500), 19♀ (AMNH_PBI 00062501–AMNH_PBI 00062519) (AMNH). Gila Bend, 32.94778°N 112.71611°W, 260 m, 06 Oct 1940, L.L. Stitt, 5♂ (AMNH_PBI 00070139–AMNH_PBI 00070143) (USNM). Salt River Canyon at Apache Lake, 33.55811°N 111.53153°W, 610 m, 28 Apr 1981, D.A. and J.T. Polhemus, 4♂ (AMNH_PBI 00063451–AMNH_PBI 00063453, AMNH_PBI 00063960), 9♀ (AMNH_PBI 00063426, AMNH_PBI 00063454–AMNH_PBI 00063461) (JTP). Sierra Estrella, 33.00111°N 112.41667°W, 24 Apr 1983, J.T. and D.A. Polhemus, 2♂ (AMNH_PBI 00063440, AMNH_PBI 00063441), 1♀ (AMNH_PBI 00063442) (JTP). Sunflower, 33.8642°N 111.46763°W, 23 May 1982, D.A. and J.T. Polhemus, 1♂ (AMNH_PBI 00063439) (JTP). ***Pima Co.:*** 20 mi W of Tucson, 32.22°N 111.26°W, 29 Apr 1985, W.F. Chamberlain, 1♂ (AMNH_PBI 00056059), 1♀ (AMNH_PBI 00056060) (TAMU). 7.5 mi S of Coronado Natl. Forest boundary on Mount Lemmon Rd, 32.31°N 110.72°W, 1433 m, 11 Jun 1983, Schuh, Schwartz, and Stonedahl, 2♀ (AMNH_PBI 00062384, AMNH_PBI 00062385) (AMNH). Organ Pipe Cactus National Monument, 5 mi N of Lukeville, 32.04166°N 112.87527°W, 528 m, 16 Apr 1987–22 Apr 1987, Kevin Haack, 10♂ (AMNH_PBI 00056017–AMNH_PBI 00056026), 5♀ (AMNH_PBI 00056027–AMNH_PBI 00056031) (TAMU). Santa Catalina Mountains, 32.5°N 110.92056°W, 823 m, 05 Aug 1924–25 Sep 1924, A.A. Nichol, 1♂ (AMNH_PBI 00068693) (USNM). Tucson, 32.22167°N 110.92583°W, 732 m, 15 Aug 1935,

Jean Russell, 1♂ (AMNH_PBI 00074868) (KU). Tucson, Jackson St, 32.22167°N 110.92583°W, 22 Jun 1980, K. Schmidt and G. Thompson, 9♂ (AMNH_PBI 00062376–AMNH_PBI 00062383, AMNH_PBI 00063141), 20♀ (AMNH_PBI 00062386–AMNH_PBI 00062403, AMNH_PBI 00063134, AMNH_PBI 00063140) (AMNH). ***Pinal Co.:*** Maricopa, 33.05806°N 112.04694°W, 17 Oct 1927, J. A. Kusche, 1♂ (AMNH_PBI 00077145) (CAS). ***Santa Cruz Co.:*** 7 mi S of Sonoita, 31.57784°N 110.65472°W, 25 Jun 1982, Oman, 1♂ (AMNH_PBI 00075927) (ORSU). Nogales, 31.34028°N 110.93361°W, 08 May 1997, G.M. Chamberlain, 2♂ (AMNH_PBI 00056057, AMNH_PBI 00056058) (TAMU); 05 Aug 1967, L.A. Kelton, 1♂ (AMNH_PBI 00123260) (CNC). ***Yavapai Co.:*** 1 mi E of Yarnell, 34.22167°N 112.72918°W, 29 Apr 1981, D.A. and J.T. Polhemus, 8♂ (AMNH_PBI 00063443–AMNH_PBI 00063450) (JTP). 12 mi SW of Sedona, 34.74654°N 111.9103°W, 26 Jun 1982, Oman, 1♂ (AMNH_PBI 00075926) (ORSU). 4 mi SE of Mayer, 34.35674°N 112.18583°W, 21 Jun 1982, Oman, 2♂ (AMNH_PBI 00075924, AMNH_PBI 00075925), 8♀ (AMNH_PBI 00075921, AMNH_PBI 00075929–AMNH_PBI 00075935) (ORSU). Cottonwood, 36.07306°N 109.89167°W, 13 Aug 1975, J.C. Schaffner, 6♂ (AMNH_PBI 00056032–AMNH_PBI 00056037), 5♀ (AMNH_PBI 00056038–AMNH_PBI 00056042) (TAMU). ***Yuma Co.:*** Dome, 32.75528°N 114.36139°W, 06 Apr 1978, J.D. Pinto, *Prosopis* sp. (Fabaceae), 1♂ (AMNH_PBI 00082309) (UCR). Wellton, 32.67278°N 114.14611°W, 05 May 1918, J.C. Bradley, 1♂ (AMNH_PBI 00076942) (CU). **California:** ***Imperial Co.:*** 2 mi E of Holtville, 32.81111°N 115.3449°W, 24 Apr 1973, Oman, 1♂ (AMNH_PBI 00075928) (ORSU). 2.3 mi NW of Glamis, 32.99°N 115.0719°W, 338 m, 13 Apr 1968, L.O. Tejada, 3♂ (AMNH_PBI 00083552–AMNH_PBI 00083554) (UCR). ***Inyo Co.:*** Ballarat, Panamint Valley, 36.04773°N 117.22339°W, 332 m, 10 Jun 1961, H.F. Howden, 2♂ (AMNH_PBI 00072092, AMNH_PBI 00072093), 1♀ (AMNH_PBI 00123259) (CNC). Resting Springs, 35.87774°N 116.15807°W,540 m, 29 May 1955, Belkin et al., 1♂ (AMNH_PBI 00074207) (LACM). ***Riverside Co.:*** Indio, 33.72056°N 116.21472°W, 05 Aug 1935, R.H. Beamer, 1♂ (AMNH_PBI 00074869) (KU). ***San Diego Co.:*** Anza-Borrego Desert State Park, Palm Canyon Trail, 33.22111°N 116.33333°W, 183 m, 17 May 1982, M.D. Schwartz, *Prosopis glandulosa* (Fabaceae), 19♂ (AMNH_PBI 00062404–AMNH_PBI 00062422), 1♀ (AMNH_PBI 00063139) (AMNH). **Nevada:** ***Nye Co.:*** Fairbanks Spring, Ash Meadows, 36.49023°N 116.34143°W, 689 m, 01 Jun 1951, Ted Frantz, 5♂ (AMNH_PBI 00077150–AMNH_PBI 00077153, AMNH_PBI 00077214) (CAS). **New Mexico:** ***Dona Ana Co.:*** Mesilla Park, 32.27°N 106.80028°W, 12 Jul 1917, H.H. Knight, 1♂ (AMNH_PBI 00068694) (USNM). **Texas:** ***Brewster Co.:*** 5 mi N of Big Bend National Park on Rt 385, 29.75471°N 103.15881°W, 26 Apr 1978, T.J. Henry and R.T. Schuh, *Prosopis glandulosa* (Fabaceae), 7♂ (AMNH_PBI 00062440–AMNH_PBI 00062445, AMNH_PBI 00063118), 22♀ (AMNH_PBI 00062446–AMNH_PBI 00062465, AMNH_PBI 00063137, AMNH_PBI 00063138) (AMNH). **Utah:** ***Washington Co.:*** Santa Clara on Rt 56, T42S R16W, 37.13306°N 113.65333°W, 853 m, 23 May 1981, M.D. Schwartz, *Prosopis juliflora* (Fabaceae), 11♂ (AMNH_PBI 00062467–AMNH_PBI 00062476, AMNH_PBI 00063117), 1♀ (AMNH_PBI 00063136) (AMNH).

Salicopsallus, new genus

Type species: *Salicopsallus schwartzi*, new species.

DIAGNOSIS: Recognized uniquely by the sclerotized keel-like dorsal margin of the apical portion of the phallotheca (figs. 36, 37), in combination with the tubercle on the left side of the pygophore (fig. 35E–H), the pale coloration (with or without spots on the hemelytra) (fig. 3), the roughly J-shaped vesica, terminating in a single spine, the secondary gonopore subtended by a small spinelike appendage, the flattened thumblike phallothecal spine on the anterior face of the phallotheca, the left paramere with the anterior process curving and acuminate, and the posterior process usually truncate, of a form common to many Phylinae (figs. 36, 37). Species with uniformly pale coloration similar in appearance to some pale-colored *Plagiognathus* spp., but easily separated from them by the presence of a tubercle on the left side of the pygophore, as well as the detailed structure of the male genitalia. Also potentially confused with faded, or otherwise pale, *Phymatopsallus*, *Angelopsallus*, and *Knightopsallus* spp., but separated from the first by the structure of the male genitalia, and by the absence of a process on the left side of the pygophore in the last two. Species with spotted dorsum separated from *Stictopsallus* by the absence of a tubercle on the pygo-

phore in that group, and from *Bisulcopsallus* and *Ceratopsallus* by the very large pygophore in those groups and the details of male genitalic structure.

DESCRIPTION: *Male:* Size small to moderate among *Phymatopsallus*-group taxa, elongate ovoid to nearly parallel-sided, total length 2.59–3.15, length apex clypeus–cuneal fracture 1.73–2.18, width pronotum 0.84–1.01. COLORATION (fig. 3): Body and forewings either pale or with green or brown spots on the clavus, corium, and cuneus; eyes silvery or pale to dark; appendages pale; femora with scattered weak brown spots; tibial spines pale, with small weakly brown spots at bases; membrane weakly marmorate, veins pale. SURFACE AND VESTITURE (figs. 3, 35C): Dorsal body surface smooth, impunctate, weakly shining. Dorsal vestiture of reclining, pale, simple setae intermixed with recumbent, silvery, sericeous setae. STRUCTURE: Head: Short, transverse, closely conforming to anterior margin of pronotum; frons at most barely protruding beyond anterior margin of eyes; posterior margin of vertex rounded; eyes large in dorsal and lateral views (figs. 3, 35A); antennae inserted above ventral margin of eyes by distance somewhat greater than diameter of antennal segment 1, antennal insertion contiguous with eye (fig. 35A); antennal segment 2 cylindrical, not tapered, about the same diameter as antennal segment 1 (fig. 3); labium reaching from posterior margin of middle trochanters to posterior margin of hind trochanters. Thorax: Mesothoracic spiracle and metathoracic scent-efferent system as in figure 35A, B. *Legs:* Claws moderately elongate, rather strongly curving, pulvilli flaplike, parempodia setiform (fig. 35D). Abdomen: Broad. GENITALIA (figs. 35G, 36, 37): Pygophore: Moderately large, conical, with seta-covered tubercle on the left side just anterior to opening (fig. 35E–H). Vesica: Formed of a single relatively slender strap, roughly J-shaped, with at most one-half twist (see *S. schwartzi*, new species), apically attenuated, extending beyond secondary gonopore by distance equal to about length of gonopore; secondary gonopore of small to moderate size, well sclerotized, ovoid, without distinct gonopore sclerite, but with a small sclerotized appendage located near base. Phallotheca: Apical portion tapered, rather short, dorsal margin bearing a distinct sclerotized "keel" over most of length, and with a thumblike spine on the anterior surface. Parameres: Left paramere with anterior process flattened, sclerotized, sinuously curving and attenuated, posterior process of form typical of Phylinae; right paramere elongate, crudely parallel-sided, apex with pair of terminal processes weakly developed.

Female: Elongate ovoid; total length 2.17–3.34, length apex clypeus–cuneal fracture 1.52–2.56, width pronotum 0.89–1.06. COLORATION (fig. 3): As in male. SURFACE AND VESTITURE: As in male. STRUCTURE: Hemelytra just covering abdomen; eyes smaller than those of male, frons more prominently bulging anterior to eyes, head projecting below eyes by distance about equal to diameter of antennal segment 1; antennal segment 2 more slender than in male, tapered toward base (fig. 3). GENITALIA (fig. 36): Sclerotized rings ovoid, somewhat twisted; vestibulum forming a relatively short sclerotized tube; posterior wall simple, posterior fourth with small spicules laterally and medially with a sclerotized transverse "lobe".

ETYMOLOGY: Named for the occurrence of members of the group on the genus *Salix* (Salicaceae).

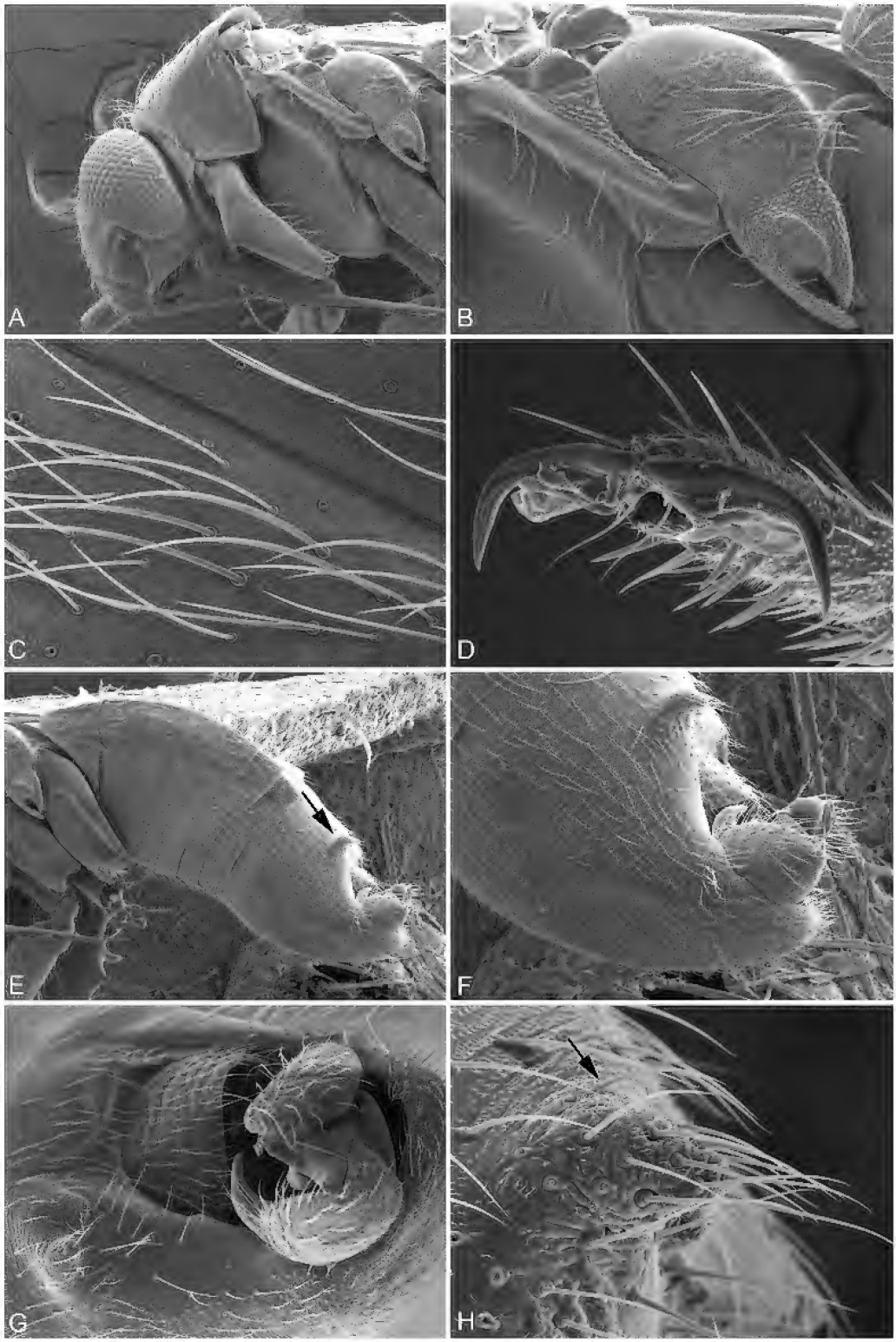
HOSTS: *Salix* sp. (Salicaceae); *Ziziphus* sp. (Rhamnaceae); *Fraxinus velutinus* (Oleaceae).

DISCUSSION: The uniform coloration of the dorsum and the vesical spine suggest an association of *Salicopsallus* with *Phymatopsallus*, even though the nonfabaceous hosts of *Salicopsallus* might suggest otherwise.

Salicopsallus lucidus (Van Duzee), new combination
figures 3, 35, 36; map 8

Tuponia lucida Van Duzee, 1918: 303 (n.sp.).
Phymatopsallus cuneopunctatus Knight, 1964: 134 (n.sp.). NEW SYNONYMY.

DIAGNOSIS: Distinguished from *S. schwartzi* by the entirely pale coloration of the dorsum (fig. 3), and the longer, more sinuously curving vesica.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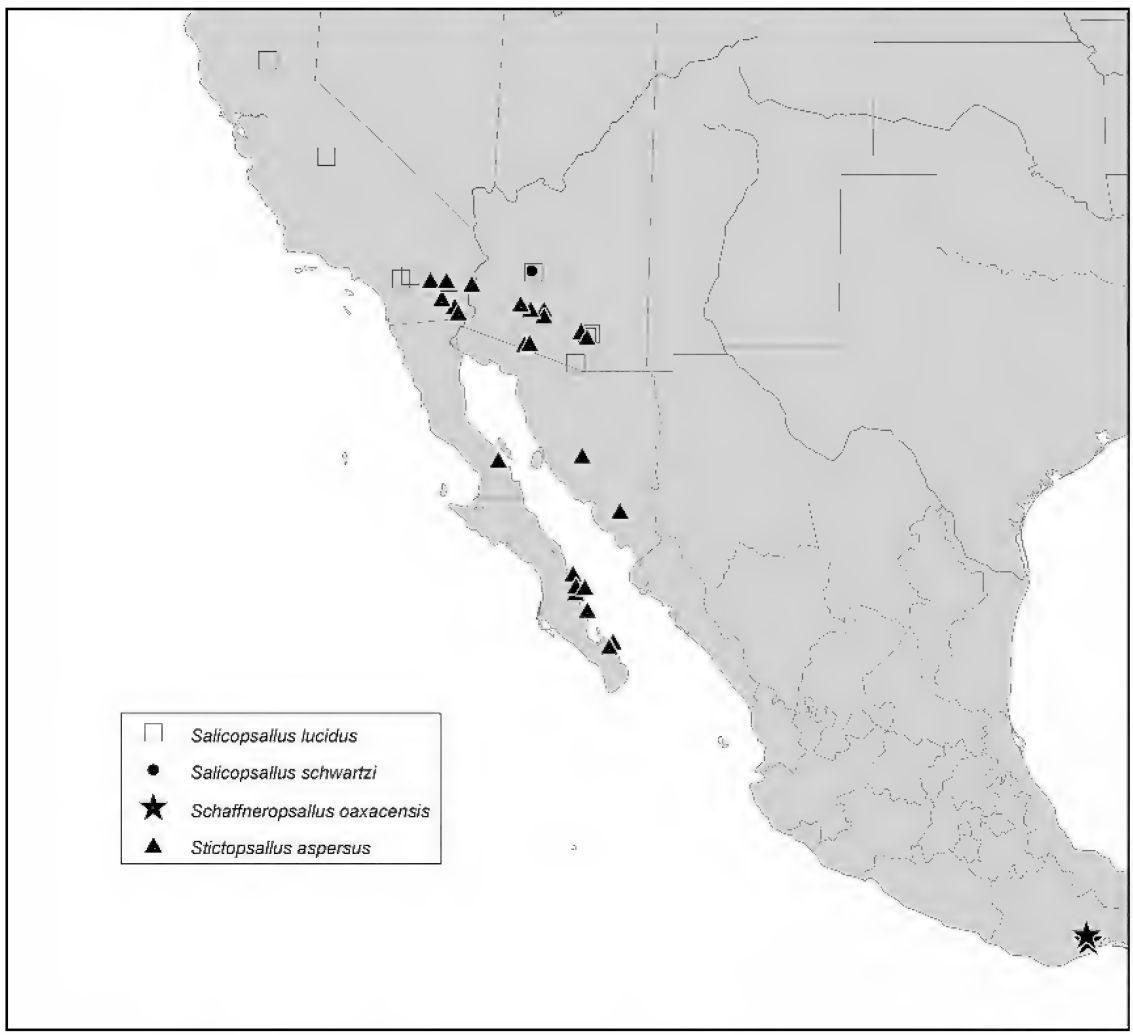

Map 8. Distribution of *Salicopsallus*, *Stictopsallus*, and *Schaffneropsallus* spp.

REDESCRIPTION: *Male:* Size moderate among *Phymatopsallus*-group taxa, elongate ovoid, total length 2.66–3.15, length apex clypeus–cuneal fracture 1.86–2.18, width pronotum 0.84–1.01. COLORATION (fig. 3): Pale, pronotum and scutellum sometimes weakly greenish; membrane marmorate, veins pale. SURFACE AND VESTITURE (figs. 3, 35C): As in generic description. STRUCTURE: Head: Labium reaching from posterior margin of middle trochanters to posterior margin of hind trochanters.

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Fig. 35. *Salicopsallus lucidus*. **A.** Lateral view of head. **B.** Mesothoracic spiracle and metathoracic scent-efferent system. **C.** Setae on hemelytron. **D.** Frontal view of pretarsus. **E.** Lateral view of male abdomen (arrow indicates tubercle on pygophore). **F.** Lateral view of male pygophore. **G.** Posterodorsal view of pygophore. **H.** Detail of tubercle on left side of pygophore.

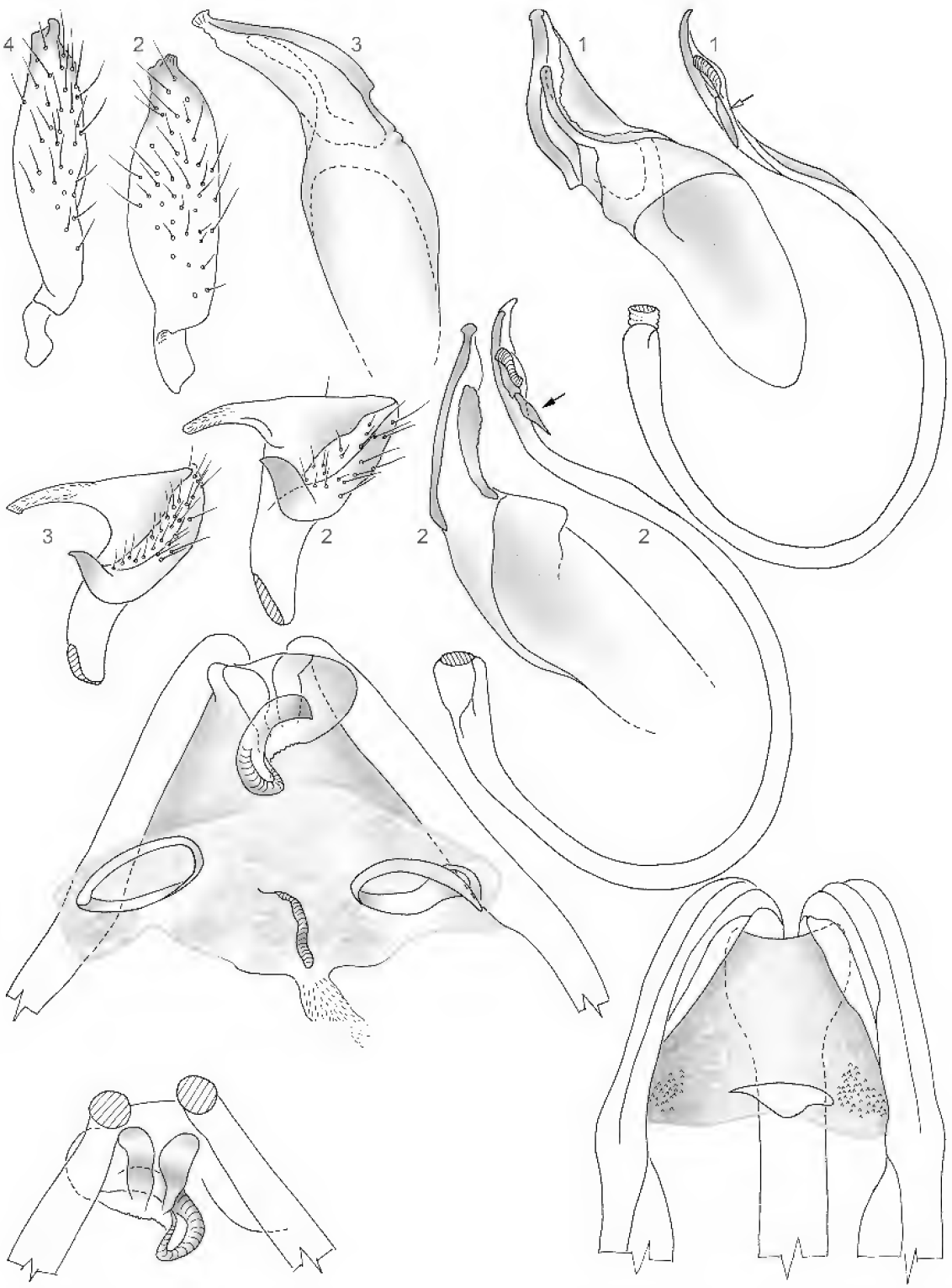


Fig. 36. *Salicopsallus lucidus:* Male genitalia (male 1, AMNH_PBI 00071869; male 2, 00062261; male 3, 00077104; male 4, 00063160); female genitalia (AMNH_PBI 00062272).

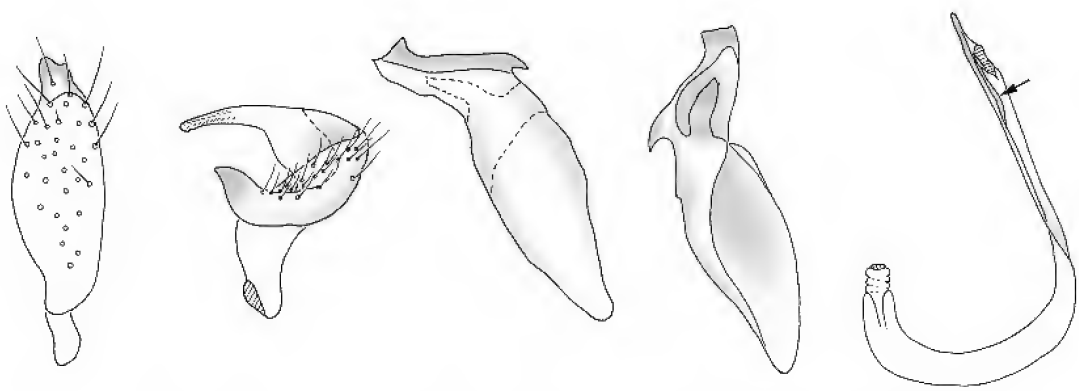


Fig. 37. *Salicopsallus schwartzi:* Male genitalia (AMNH_PBI 00063162).

GENITALIA (fig. 36): Vesica: With overall shape of a J, larger and more sinuously curving than in *S. schwartzi*, new species, recurved on apical one-fourth, apex extending beyond secondary gonopore by about 1.5 times length of gonopore; appendage subtending gonopore lanceolate, moderately elongate. Phallotheca: Spine relatively long, shaped like an elongate club; sclerotized dorsal margin smoothly curving, without additional ornamentation.

Female: Elongate ovoid; total length 2.76–3.34, length apex clypeus–cuneal fracture 1.94–2.46, width pronotum 0.90–1.06. COLORATION (fig. 3): As in male. SURFACE AND VESTITURE: As in male. STRUCTURE: Similar to male. GENITALIA (figs. 36): See generic description.

HOSTS: Recorded from *Salix exigua* Nutt., *Salix x pendulina* Wenderoth (Salicaceae), and *Fraxinus velutina* Torr. (Oleaceae). A single specimen recorded from *Eriodictyon crassifolium* var. *crassifolium* Benth. (Hydrophyllaceae) is almost certainly not an indication of breeding on that host.

DISTRIBUTION (map 8): Widely distributed from Butte County in northern California, south to Riverside County, and east to Maricopa and Pima Counties in Arizona.

DISCUSSION: This species was described by Van Duzee (1918) from willows (*Salix* sp.) growing near Palm Springs, California. It was not included in the 1964 revision of Knight. The current generic placement is based on the pale coloration and the existence of specimens of similar size and coloration from Arizona and the Sierra Nevada Mountains of California, also collected on *Salix* sp. The holotype male, deposited in the California Academy of Sciences, has no abdomen, so comparison of the male genitalia for additional confirmation of the identity of this taxon was not possible.

Even though there is some variation in size and coloration in the specimens I am identifying as *S. lucidus*, the genitalic structure of specimens ranging from the northern Sierra Nevada Mountains to southern Arizona is substantially similar.

Most of the specimens from Arivaca Lake, Pima County, Arizona, have red eyes, in contrast to the whitish or silvery eyes in nearly all other known specimens. I attribute this to the fact that they are teneral.

Knight (1964) described *Phymatopsallus cuneopunctatus* on the basis of a single female (USNM) from Tucson, Arizona, collected July 5, 1928, by A.A. Nichol; judging from the lepidopteran scales adhering to the specimen, it was collected at light. He noted that the hemelytra were pallid with fuscous dots only on the cuneus; my examination of the holotype indicates that these dots are extremely difficult to see. Knight (1964) compared *P. cuneopunctatus* with *B. fuscipunctatus* (Knight), but treated them as distinct because of the size difference (length 2.7 as compared to 2.9). My examination of the holotype female indicates that this is

almost certainly not a *Phymatopsallus* species, and that the comparison with *B. fuscipunctatus* does little to clarify the actual relationships of this nominal taxon. On the basis of size, coloration, and the nearly hyaline nature of the hemelytra, this nominal taxon is actually the same as *Salicopsallus lucidus*, and I am therefore treating it as such.

HOLOTYPES: **USA: Arizona: *Pima Co.:*** Tucson [32.22167°N 110.92583°W], 05 Jul 1928, A.A. Nichol, 1♀ (AMNH_PBI 00069801) (USNM) (*S. cuneopunctatus*). **California: *Riverside Co.:*** Palm Springs [33.83028°N 116.54444°W], 21 May 1917, E.P. Van Duzee, 1♂ (AMNH_PBI 00077827) (CAS) (*S. lucidus*).

PARATYPES: **USA: California: *Riverside Co.:*** Palm Springs, 33.83028°N 116.54444°W, 21 May 1917, E.P. Van Duzee, 1♀ (AMNH_PBI 00068777) (CAS) (*S. lucidus*).

OTHER SPECIMENS EXAMINED: **USA: Arizona: *Maricopa Co.:*** Hassayapa River Riparian Area on Rt 60, 8 mi SE of Wickenburg, 33.90872°N 112.6749°W, 575 m, 15 May 2000, M.D. Schwartz, *Salix exigua* (Salicaceae), det. ASC staff ASC75856, 13♂ (AMNH_PBI 00062258–AMNH_PBI 00062263, AMNH_PBI 00062737, AMNH_PBI 00062738, AMNH_PBI 00063171–AMNH_PBI 00063175), 28♀ (AMNH_PBI 00062264–AMNH_PBI 00062278, AMNH_PBI 00062280, AMNH_PBI 00062283, AMNH_PBI 00062286–AMNH_PBI 00062291, AMNH_PBI 00063189–AMNH_PBI 00063193) (AMNH). *Salix exigua* (Salicaceae), det. ASC staff ASC75856, 2♂ (AMNH_PBI 00062735, AMNH_PBI 00062736), 2♀ (AMNH_PBI 00062279, AMNH_PBI 00062281) (CNC). *Salix exigua* (Salicaceae), det. ASC staff ASC75856, 3♂ (AMNH_PBI 00062732–AMNH_PBI 00062734), 3♀ (AMNH_PBI 00062282, AMNH_PBI 00062284, AMNH_PBI 00062285) (USNM). ***Pima Co.:*** Arivaca Lake, 31.52551°N 111.2546°W, 1170 m, 22 May 2000, M.D. Schwartz, *Salix x pendulina* (Salicaceae), det. H.D. Hammond ASC75859, 7♂ (AMNH_PBI 00062292, AMNH_PBI 00062293, AMNH_PBI 00063156–AMNH_PBI 00063160), 22♀ (AMNH_PBI 00062296–AMNH_PBI 00062309, AMNH_PBI 00062314–AMNH_PBI 00062316, AMNH_PBI 00063176–AMNH_PBI 00063180) (AMNH). Santa Catalina Mts, trail N of Bear Canyon Rd, 32.30147°N 110.8022°W, 810 m, 23 May 2000, M.D. Schwartz, *Fraxinus velutina* (Oleaceae), det. H.D. Hammond ASC75863, 6♀ (AMNH_PBI 00062294, AMNH_PBI 00062295, AMNH_PBI 00062310–AMNH_PBI 00062313) (AMNH). **California: *Butte Co.:*** Oroville, 39.51389°N 121.55528°W, 24 Jun 1927, H.H. Keifer, *Salix hindsiana* (Salicaceae), 4♂ (AMNH_PBI 00077104, AMNH_PBI 00077105, AMNH_PBI 00077120, AMNH_PBI 00077121), 15♀ (AMNH_PBI 00077106–AMNH_PBI 00077117, AMNH_PBI 00077122–AMNH_PBI 00077124) (CAS). ***Fresno Co.:*** Dry Creek, E of Humphreys Station on Tollhouse Rd, 36.96162°N 119.44568°W, 317 m, 25 Jul 1999, M.D. Schwartz, *Salix* sp. (Salicaceae), 3♂ (AMNH_PBI 00071869–AMNH_PBI 00071871), 2♀ (AMNH_PBI 00071872, AMNH_PBI 00071873) (CNC). ***Riverside Co.:*** 10 mi E of Hemet, San Bernardino National Forest, 33.73813°N 116.838°W, 581 m, 20 May 2004, Schuh, Cassis, Schwartz, Weirauch, Wyniger, Forero, *Eriodictyon crassifolium var. crassifolium* (Hydrophyllaceae), det. A. Sanders UCR140621, 1♂ (AMNH_PBI 00170510) (AMNH).

Salicopsallus schwartzi, new species
figures 3, 37; map 8

DIAGNOSIS: Distinguished from *S. lucidus* by the green spots on the dorsum (fig. 3), and the shorter, J-shaped vesica.

DESCRIPTION: *Male:* Relatively small among *Phymatopsallus*-group taxa, elongate ovoid, total length 2.59–2.67, length apex clypeus–cuneal fracture 1.73–1.77, width pronotum 0.89. COLORATION (fig. 3): Pale to weakly greenish, corium, clavus, and cuneus rather densely covered with greenish spots; membrane boldly marmorate, veins pale. SURFACE AND VESTITURE (fig. 3): As in generic description. STRUCTURE: Head: Length of labium not readily determined from available specimens. GENITALIA (fig. 37): Vesica: Overall shape that of a J, much shorter than in *S. lucidus*, apex relatively narrow and extending beyond secondary gonopore by about the length of gonopore; appendage subtending gonopore elongate, slender. Phallotheca: Spine relatively short, tapered toward apex; sclerotized dorsal margin of phallotheca with a triangular projection near apex and with a retrorse barb proximally.

Female: Elongate ovoid; total length 2.17–2.35, length apex clypeus–cuneal fracture 1.52–1.65, width pronotum 0.78–0.84. COLORATION (fig. 3): As in male. SURFACE AND VESTITURE: As in male. STRUCTURE: Similar to male. GENITALIA: Not examined.

ETYMOLOGY: Named after Michael D. Schwartz, who collected and documented the hosts of many of the known specimens available for the genus *Salicopsallus*.

HOSTS: *Zizyphus obtusifolia canescens* (Hooker ex T&G) (Rhamnaceae).

DISTRIBUTION (map 8): Known only from Yavapai County, central Arizona.

HOLOTYPE: **USA: Arizona: *Yavapai Co.:*** Just N of Wickenberg [33.96864°N 112.72962°W], 625 m, 19 Jun 1980, R.T. Schuh, *Zizyphus obtusifolia canescens* (A. Gray) M.C. Johnst. (Rhamnaceae), det. B. Ertter, 1980 NYBG, 1♂ (AMNH_PBI 00063162) (AMNH).

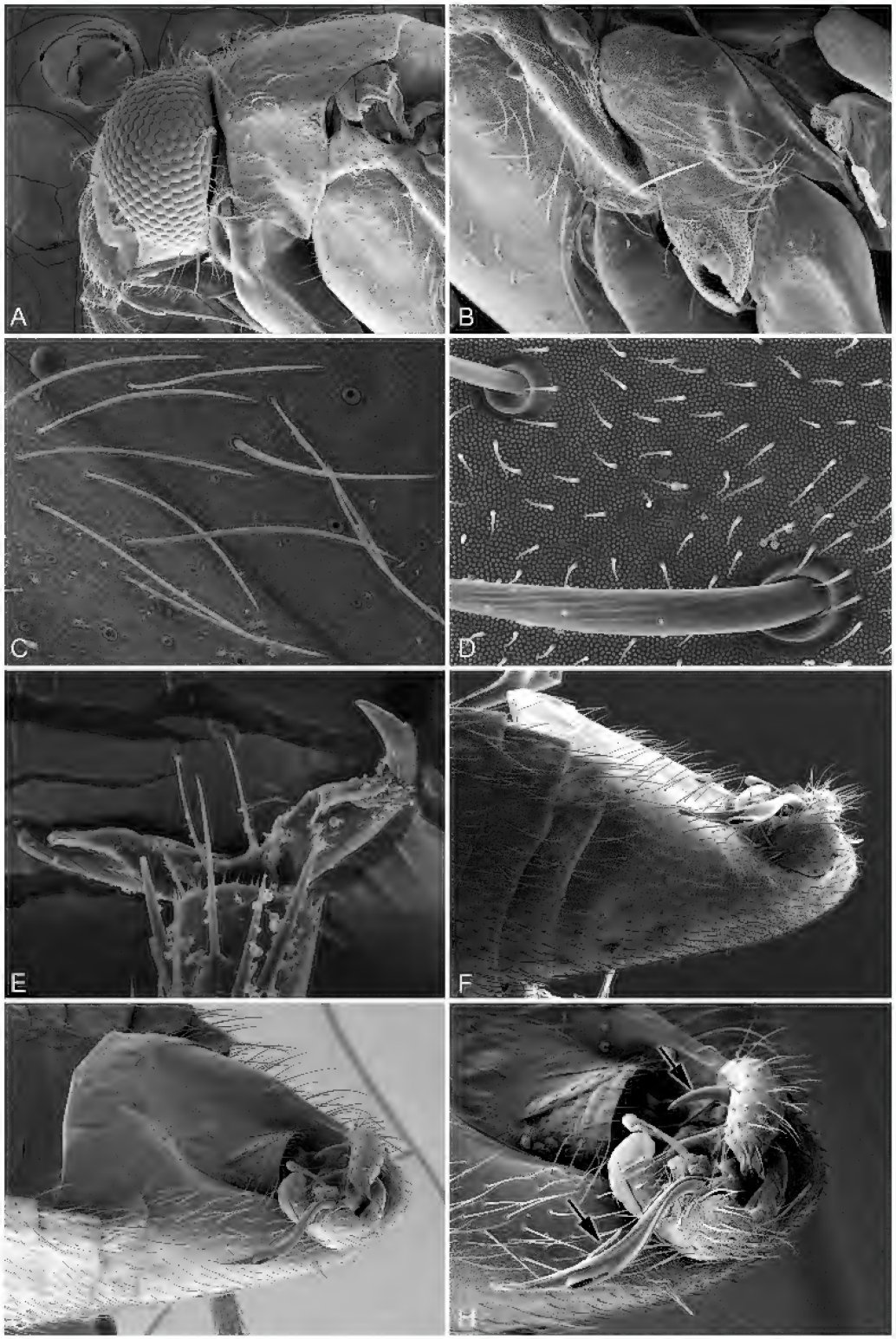
PARATYPES: **USA: Arizona: *Yavapai Co.:*** Just N of Wickenberg, 33.96864°N 112.72962°W, 625 m, 19 Jun 1980, R.T. Schuh, *Zizyphus obtusifolia canescens* (Rhamnaceae), det. B. Ertter, 1980 NYBG, 3♂ (AMNH_PBI 00062710, AMNH_PBI 00062711, AMNH_PBI 00063161), 21♀ (AMNH_PBI 00062716–AMNH_PBI 00062731, AMNH_PBI 00063163–AMNH_PBI 00063167) (AMNH), 2♀ (AMNH_PBI 00062714, AMNH_PBI 00062715) (CNC), 2♀ (AMNH_PBI 00062712, AMNH_PBI 00062713) (USNM).

Stictopsallus, new genus

Type species: *Psallus aspersus* Van Duzee.

DIAGNOSIS: Recognized among *Phymatopsallus*-group taxa by the relatively small size, pale greenish background coloration of the body, a uniform covering of small green or brown spots on the clavus, corium, and cuneus, and strong sexual dimorphism in the eyes and antennae (fig. 3), the absence of a tubercle and associated setae on the left side of the pygophore (fig. 38F, G), uniquely by the phallotheca with two hornlike processes projecting from the dorsal surface, and by the anterior process of the left paramere in the form of a finch beak (figs. 38G, H, 39). Vesica more or less J-shaped, gonopore distinctly sclerotized, subapical, with a short spine on the dorsal edge of the vesica at the midpoint of the gonopore (fig. 39), the last feature shared in a substantially similar form with *Salicopsallus* spp. Distinguished from *Bisulcopsallus* and *Ceratopsallus* by the smaller pygophore and the absence of a tubercle on the left side of the pygophore. Distinguished from *Cercocarpopsallus* and *Salicopsallus* by the presence of a group of short spinelike setae on the left side of the pygophore in the former and a tubercle with associated setae in the latter.

DESCRIPTION: *Male:* Moderately small among *Phymatopsallus*-group taxa, weakly to moderately elongate, nearly parallel-sided, total length 2.28–2.84, length apex clypeus–cuneal fracture 1.65–1.96, width pronotum 0.57–0.97. COLORATION (fig. 3): Body and forewings pale greenish, often yellowish in preserved specimens, with a uniform covering of small green or brown spots on the clavus, corium, and cuneus (fig. 3); eyes silvery or pale to dark; appendages pale, weakly yellowish to greenish; femora with scattered weak brown spots; tibial spines pale, with small weakly brown spots at bases; membrane weakly marmorate, veins pale. SURFACE AND VESTITURE (figs. 3, 38C, D): Dorsal body surface smooth, impunctate, weakly shining. Dorsal vestiture of reclining, pale, simple setae intermixed with recumbent, silvery, sericeous setae. STRUCTURE: Head: short, transverse, closely conforming to anterior margin of pronotum (fig. 3); frons at most barely protruding beyond anterior margin of eyes (fig. 38A); posterior margin of vertex rounded; eyes large in dorsal and lateral views (figs. 3, 38A); antennae inserted above ventral margin of eyes by distance somewhat greater than diameter of antennal segment 1, antennal insertion contiguous with eye (fig. 38A); antennal segment 2 cylindrical, not tapered, about the same diameter as antennal segment 1 (fig. 3); labium reaching to about posterior margin of middle trochanters. Thorax: Mesothoracic spiracle and metathoracic scent-efferent system as in figure 38B. *Legs:* Claws moderately elongate, rather strongly curving, pulvilli flaplike, parempodia setiform (fig. 38E). Abdomen: Broad. GENITALIA (figs. 38F–H, 39): Pygophore: Moderately large, conical (fig. 38F, G). Vesica: Formed of a single relatively slender strap, roughly J-shaped, with one-half twist proximal to secondary gonopore, apically, extending beyond secondary gonopore by distance equal to about length of gonopore; secondary gonopore small, well sclerotized, ovoid, without distinct gonopore sclerite, but with a small sclerotized appendage located on dorsal surface of vesica at


A
B
C
D
E
F
H

about midpoint of gonopore. Phallotheca: Apical portion rather short, truncate, dorsal margin bearing two large curving hornlike spines. Parameres: Left paramere with anterior process flattened, sclerotized, and in the form of a finch beak, posterior process of form typical of Phylinae; right paramere elongate, crudely parallel-sided, apex with pair of terminal processes weakly developed.

Female: Elongate ovoid; total length 2.43–2.86, length apex clypeus–cuneal fracture 1.61–1.97, width pronotum 0.83–1.02. COLORATION (fig. 3): As in male. SURFACE AND VESTITURE: As in male. STRUCTURE: Hemelytra just covering abdomen; eyes smaller than those of male, frons more prominently bulging anterior to eyes, head projecting below eyes by distance equal to somewhat less than diameter of antennal segment 1; antennal segment 2 more slender than in male, tapered toward base. GENITALIA (fig. 39): Sclerotized rings ovoid, weakly folded; vestibulum with small sclerites and no obvious elongate tubular development as so conspicuously seen in *Angelopsallus*, *Bisulcopsallus*, and *Ceratopsallus*; posterior wall simple, posterior fourth laterally with small spicules and a sclerotized, transverse, median lobe.

ETYMOLOGY: Named for the spotted dorsum, from the Greek, *stictos*, spotted, in combination with the generic name *Psallus*. Gender masculine.

HOSTS: All available records indicate that the genus *Stictopsallus* is restricted to members of the Fabaceae.

DISCUSSION: *Stictopsallus aspersus* (Van Duzee) was not included by Knight (1964) in his treatment of *Phymatopsallus*, presumably because it does not have a tubercle on the left side of the pygophore. Nonetheless, the general appearance of *S. aspersus* is remarkably similar to many of the spotted species that Knight did include in his revision, and the structure of the right paramere and the marmorate membrane clearly argue for placement in the *Phymatopsallus* group.

Stictopsallus aspersus (Van Duzee), new combination
figures 3, 38, 39; map 8

Psallus aspersus Van Duzee, 1923: 159 (n.sp.).

DIAGNOSIS: Recognized by the characters given in the generic diagnosis.

REDESCRIPTION: See generic description.

HOST: Van Duzee (1923) recorded this taxon from a variety of localities in Baja California and also Santa Catalina Island, California, indicating that in all cases the specimens were taken on "palo tinto"; this is almost certainly "palo de tinto", *Haematoxylum brasiletto* (Karst.) (Fabaceae), which is known from mainland Mexico and Baja California. All more recently collected material examined for the present study was collected on *Psorothamnus* (= *Dalea*) *spinosus* (Gray) Barneby and *Olneya tesota* A. Gray (Fabaceae).

DISTRIBUTION (map 8): Know from the southernmost counties in Arizona and California, south into northwestern Mexico and much of Baja California.

DISCUSSION: The identity of this species is based on the dissection of a male paratype (CAS) from Ceralbo Island, Baja California, Mexico, the type locality, and comparison with the holotype male.

HOLOTYPE: **MEXICO: Baja California Sur:** Ceralbo Island [currently Cerralvo Island], Gulf of California [24.2125°N 109.87694°W], 29 May 1921–07 Jun 1921, E.P. Van Duzee, 1♂ (AMNH_PBI 00077843) (CAS).

PARATYPES: **MEXICO: Baja California Sur:** Aqua Verde, 25.49833°N 111.05638°W, 26 May 1921, E.P. Van Duzee, 1♂ (AMNH_PBI

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Fig. 38. *Stictopsallus aspersus*. **A.** Lateral view of head. **B.** Mesothoracic spiracle and metathoracic scent-efferent system. **C.** Setae on hemelytron. **D.** Detail of setae on hemelyton. **E.** Ventral view of pretarsus. **F.** Lateral view of male abdomen. **G.** Dorsal view of pygophore. **H.** Detailed dorsal view of pygophore, showing extruded vesica with short spine lateral to secondary gonopore (upper arrow indicates phallothecal spine, lower arrow vesical spine,).

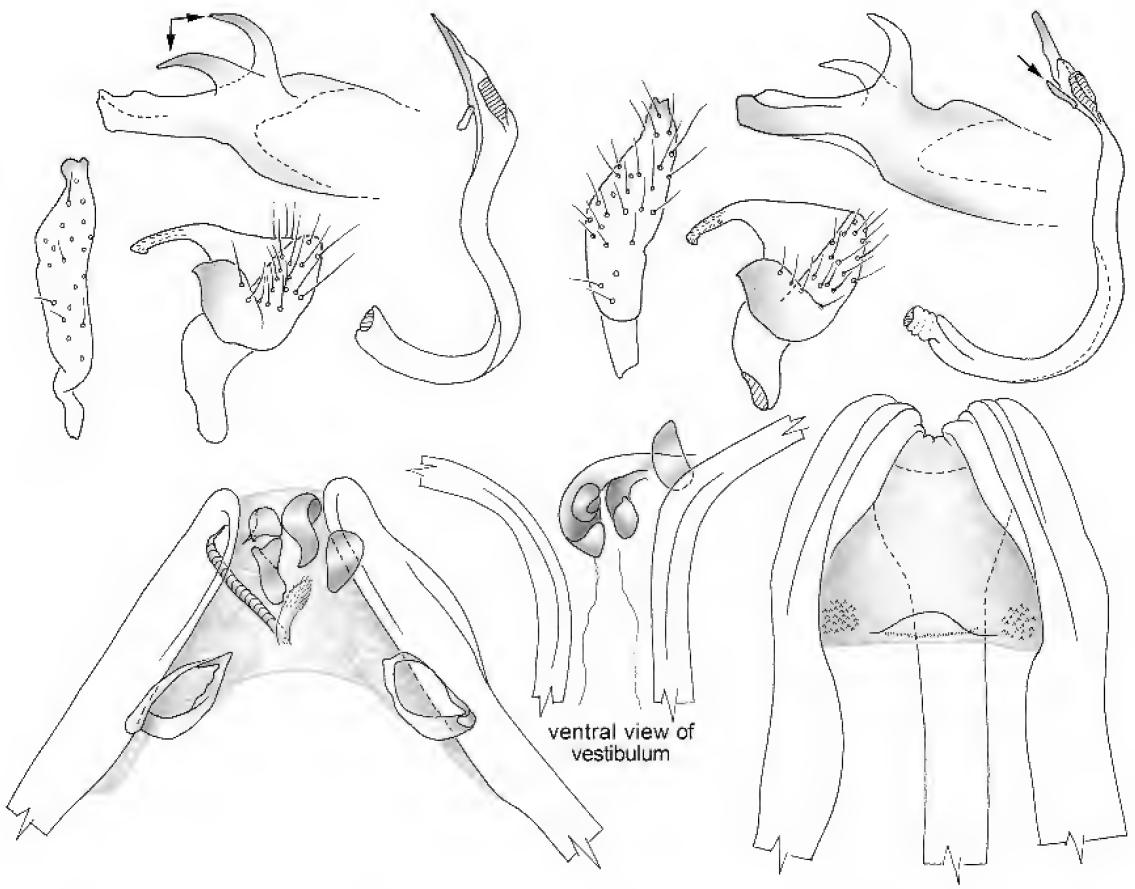

Fig. 39. *Stictopsallus aspersus:* Male genitalia (male 1 [left hand], AMNH_PBI 00062641; male 2 [right hand], AMNH_PBI 00063197); female genitalia (AMNH_PBI 00062622).

00077232) (CAS). Carmen Island, Gulf of California, Porto Ballandra, 26.00666°N 111.15111°W, 21 May 1921, E.P. Van Duzee, 1♂ (AMNH_PBI 00077231) (CAS). Cerralvo Island (formerly Ceralbo Island), Gulf of California, 24.2125°N 109.87694°W, 07 Jun 1921, E.P. Van Duzee, (Fabaceae), 3♀ (AMNH_PBI 00077216–AMNH_PBI 00077218), 1♀ (AMNH_PBI 00068591) (CAS); 29 May 1921–07 Jun 1921, E.P. Van Duzee, (Fabaceae), 1♂ (AMNH_PBI 00068609), 5♀ (AMNH_PBI 00077125–AMNH_PBI 00077128, AMNH_PBI 00077215) (CAS). Monserrate Island, Gulf of California, 25.67722°N 111.04833°W, 25 May 1921, E.P. Van Duzee, (Fabaceae), 1♀ (AMNH_PBI 00077219) (CAS). Santa Catalina Island, Gulf of California, 25.64111°N 110.78055°W, 12 Jun 1921, E.P. Van Duzee, (Fabaceae), 1♀ (AMNH_PBI 00077220) (CAS).

Other Specimens Examined: **MEXICO: Baja California Norte:** 5 km N of Bahia de los Angeles, 28.99509°N 113.55°W, 22 Apr 1985, R.T. Schuh and B.M. Massie, *Dalea spinosa* (Fabaceae), 2♀ (AMNH_PBI 00062574, AMNH_PBI 00062575) (AM). *Dalea spinosa* (Fabaceae), 15♂ (AMNH_PBI 00063089–AMNH_PBI 00063098, AMNH_PBI 00063184–AMNH_PBI 00063188), 26♀ (AMNH_PBI 00062557–AMNH_PBI 00062573, AMNH_PBI 00063099–AMNH_PBI 00063102, AMNH_PBI 00063202–AMNH_PBI 00063206), Light Trap, 1♂ (AMNH_PBI 00096963) (AMNH). *Dalea spinosa* (Fabaceae), 4♂ (AMNH_PBI 00063085–AMNH_PBI 00063088), 3♀ (AMNH_PBI 00062576–AMNH_PBI 00062578) (UNAM). **Baja California Sur:** El Sargento, 24.07806°N 109.99972°W, 29 Jul 1971, H.G. Real and R.E. Main, Light Trap, 1♂ (AMNH_PBI 00077824) (CAS). Isla San Jose, 1 mi S Punta Colorado, 25.04611°N 110.68388°W, 08 Apr 1974, J. Doyen, Light Trap, 1♂ (AMNH_PBI 00077823) (CAS). **Sonora:** 16 mi NE of Ciudad Obregon, 27.64752°N 109.74812°W, 13 May 1961, Howden and Martin,

1♂ (AMNH_PBI 00125228) (CNC). 3 mi N of Hermosillo, 29.11023°N 110.96666°W, 25 May 1961, Howden and Martin, 1♂ (AMNH_PBI 00125229) (CNC). **USA: Arizona:** ***Maricopa Co.:*** 24 mi E of Gila Bend, Freeman, 32.94778°N 112.30265°W, 530 m, 08 May 1978, R.T. Schuh and A.F. Guenther, 8♂ (AMNH_PBI 00062633–AMNH_PBI 00062640), 15♀ (AMNH_PBI 00062648–AMNH_PBI 00062662), 2 nymphs (AMNH_PBI 00062641, AMNH_PBI 00062642), 1♂ (AMNH_PBI 00063196), 1♀ (AMNH_PBI 00063215) (AMNH). 2♀ (AMNH_PBI 00062646, AMNH_PBI 00062647) (CNC). 3♀ (AMNH_PBI 00062643–AMNH_PBI 00062645) (USNM). 5 mi S of Freeman SE of Gila Bend, 32.77354°N 112.29583°W, 625 m, 08 May 1978, R.T. Schuh and A.F. Guenther, 6♂ (AMNH_PBI 00062607–AMNH_PBI 00062611, AMNH_PBI 00063195), 15♀ (AMNH_PBI 00062612–AMNH_PBI 00062625, AMNH_PBI 00063214) (AMNH). Gila Bend, 32.94778°N 112.71611°W, 260 m, 07 May 1978, R.T. Schuh, Light Trap, 1♂ (AMNH_PBI 00096964) (AMNH). Woolsey Wash near Painted Rock Dam, 33.09345°N 113.04209°W, 205 m, 03 Apr 1981, R.T. Schuh, *Dalea spinosa* (Fabaceae), 11♂ (AMNH_PBI 00062586–AMNH_PBI 00062596), 11♀ (AMNH_PBI 00062597–AMNH_PBI 00062605, AMNH_PBI 00063169, AMNH_PBI 00063170) *Dalea spinosa* (Fabaceae), 2♂ (AMNH_PBI 00063182, AMNH_PBI 00063183) (AMNH). *Dalea spinosa* (Fabaceae), 1♂ (AMNH_PBI 00062582) (CNC). *Dalea spinosa* (Fabaceae), 3♂ (AMNH_PBI 00062583–AMNH_PBI 00062585) (USNM); 09 May 1978, R.T. Schuh and A.F. Guenther, 1♀ (AMNH_PBI 00062606) (AMNH). ***Pima Co.:*** 15 mi NW of Tucson, 4500 W Flying Diamond Rd, 32.37547°N 111.10778°W, 754 m, 16 Jul 1993, N. McFarland, 3♂ (AMNH_PBI 00062629–AMNH_PBI 00062631) (AMNH). NW of Tucson on Old Father Road, 32.22167°N 110.92583°W, 762 m, 22 Apr 1982, M.D. Schwartz, *Olneya tesota* (Fabaceae), 8♂ (AMNH_PBI 00063078–AMNH_PBI 00063080, AMNH_PBI 00063197–AMNH_PBI 00063201), 8♀ (AMNH_PBI 00063081–AMNH_PBI 00063084, AMNH_PBI 00063216–AMNH_PBI 00063219) (AMNH). Organ Pipe Cactus National Monument, 5 mi N of Lukeville, 32.04166°N 112.87527°W, 528 m, 16 Apr 1987, Kevin Haack, Light Trap, 1♂ (AMNH_PBI 00058292), 1♂ (AMNH_PBI 00056173) (TAMU). Organ Pipe Cactus National Monument, Alamo Wash, 32.06907°N 112.71248°W, 750 m, 26 Mar 1981, R.T. Schuh, M.D. Schwartz, 1♂ (AMNH_PBI 00062581) (CNC). **California:** ***Imperial Co.:*** 3 mi NW of Glamis, 33.02816°N 115.10768°W, 13 Apr 1968, L.O. Tejada, 2♂ (AMNH_PBI 00082909, AMNH_PBI 00082910) (UCR). Indian Wash, 13 mi S of Hwy 78 on Ogilby Rd, 32.86361°N 114.98055°W, 105 m, 28 May 1974, J.D. Pinto, 1♂ (AMNH_PBI 00082908) (UCR); 13 Oct 1973, J.D. Pinto, 1♂ (AMNH_PBI 00082911) (UCR). Niland, 33.24°N 115.51806°W, 01 Jul 1969, R.A. Flock, *Olneya tesota* (Fabaceae), 1♂ (AMNH_PBI 00073761) (CAFA). ***Riverside Co.:*** 14 mi NE of Mecca, 33.71519°N 115.90399°W, 04 Jun 1981, J. Doyen and J. Liebherr, 3♂ (AMNH_PBI 00079774–AMNH_PBI 00079776) (UCB). Blythe, 33.6103°N 114.59634°W, 83 m, 05 Apr 1955, W.R.M. Mason, 3♂ (AMNH_PBI 00125220–AMNH_PBI 00125222), 5♀ (AMNH_PBI 00125223–AMNH_PBI 00125227) (CNC). Chuckwalla Mountains, 2.4 mi E of Corn Springs, 33.62613°N 115.32553°W, 487 m, 14 Sep 1977, J.D. Pinto, 5♂ (AMNH_PBI 00082282–AMNH_PBI 00082285, AMNH_PBI 00082913), 8♀ (AMNH_PBI 00082286–AMNH_PBI 00082292, AMNH_PBI 00082914) (UCR). Desert Center, 33.71252°N 115.4022°W, 275 m, 23 Jun 1933, R.T. Beamer, 1♂ (AMNH_PBI 00074954) (KU).

Additional New Taxon

Schaffneropsallus, new genus

Type species: *Schaffneropsallus oaxacensis*, new species.

DIAGNOSIS: Recognized by the relatively small size, average total length 2.53, the pale background coloration and orange markings on the dorsum, the uniformly fumose membrane with pale veins (fig. 3), the presence of a conspicuous tubercle with associated heavy setae of moderately length on the left side of the pygophore (fig. 40E, F), and the broadly lanceolate right paramere with an elongate, finely attenuated apex (fig. 41). Similar in dorsal aspect to some species of *Platyscytus* in the pale coloration and contrasting markings on the dorsum, but distinguished from *Platyscytus* by the head in that group being elongate and tapered ventrally. Distinguished from all *Phymatopsallus*-group taxa by the marmorate membrane of those taxa and the differences in the right paramere, that structure being blunt apically with a more or less distinct projection on either side in the *Phymatopsallus* group, but strongly attenuated and spinelike in *Schaffneropsallus*.

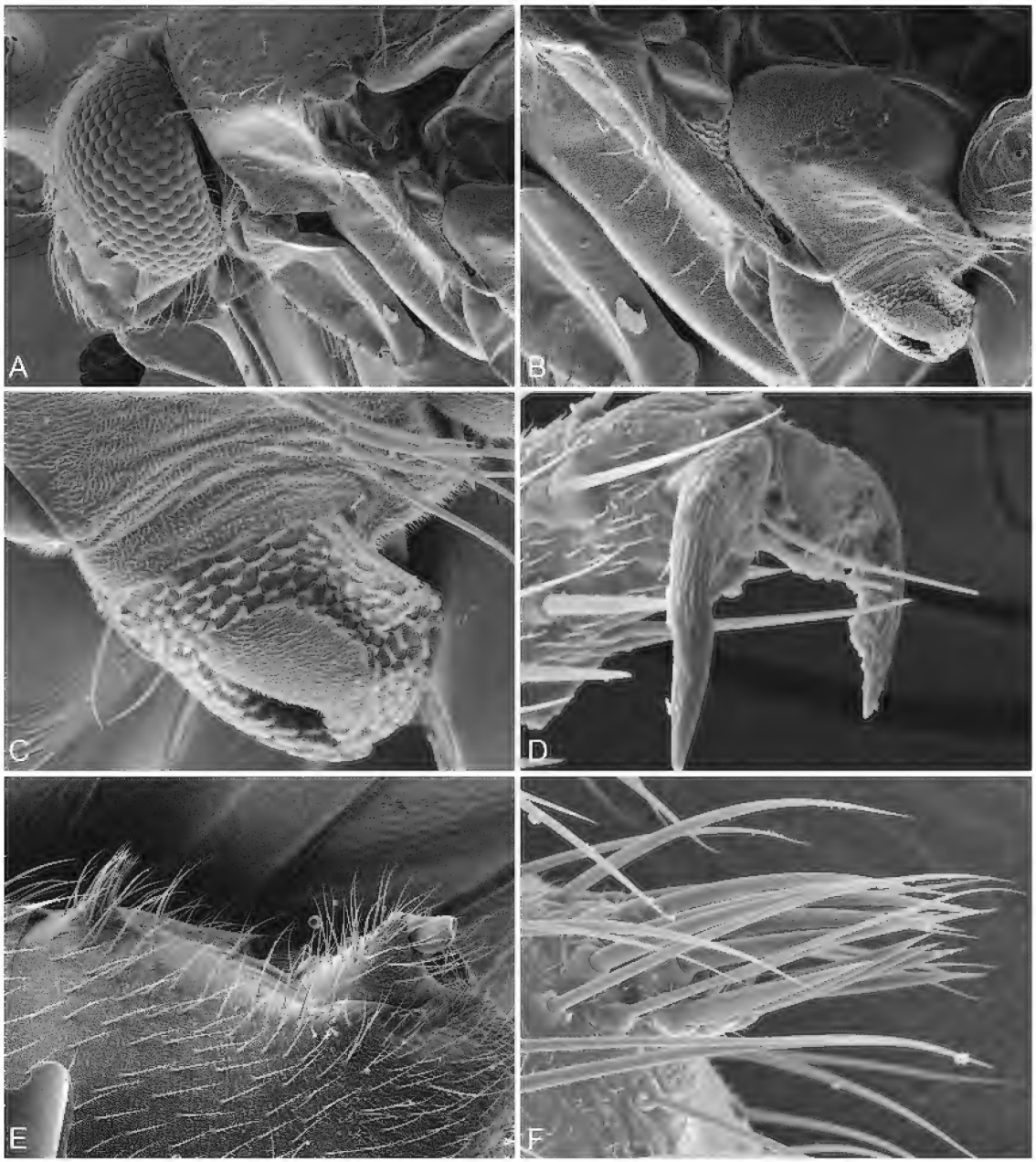

Fig. 40. *Schaffneropsallus oaxacensis*. **A.** Lateral view of head. **B.** Mesothoracic spiracle and metathoracic scent-efferent system. **C.** Detail of metathoracic scent-efferent evaporatory area. **D.** Frontolateral view of pretarsus. **E.** Lateral view of pygophore, tubercle at upper left. **F.** Detail of setae on tubercle of pygophore.

DESCRIPTION: *Male:* Relatively small, elongate, nearly parallel-sided, total length 2.41–2.65, length apex clypeus–cuneal fracture 1.75–1.87, width pronotum 0.75–0.87. COLORATION (fig. 3): Body and forewings pale, with orange markings, head with a distinct stripe on the inner margin of each eye, pronotum with three longitudinal stripes,

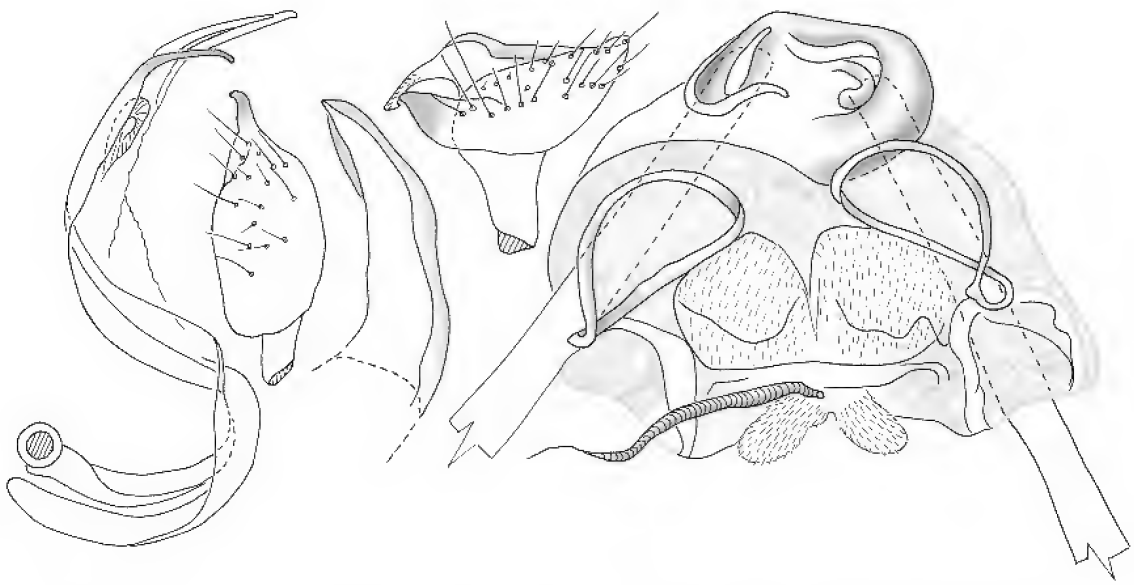

Fig. 41. *Schaffneropsallus oaxacensis:* Male genitalia (AMNH_PBI 00058288; 00058287, right paramere only); female genitalia (AMNH_PBI 00058289).

scutellum with a median longitudinal stripe, and hemelytra with numerous irregularly placed small orange spots; eyes silvery; appendages pale, femora with a few black spots; tibial spines dark with black bases; membrane fumose, veins pale. SURFACE AND VESTITURE (fig. 3): Dorsal body surface smooth, impunctate, weakly shining. Dorsal vestiture of recumbent, silvery setae. STRUCTURE: Head: Weakly transverse, posterior margin of eyes contiguous with anterior margin of pronotum, frons at most barely protruding beyond anterior margin of eyes (Fig. 40A); posterior margin of vertex indistinct; eyes large, showing sexual dimorphism, occupying entire height of head in lateral view (fig. 40A), vertex relatively narrow (fig. 3); antennae inserted below midpoint of eye, insertion contiguous with eye (fig. 40A); antennal segment 2 cylindrical, of approximately same diameter as segment 1, distinctly longer than width of head (ratio 72:60); labium reaching to apex of hind trochanters. Thorax: Mesothoracic spiracle and metathoracic scent-efferent system as in figure 40B, C. *Legs:* Claws smoothly curving over entire length, pulvilli small flaplike, arising from near midpoint of claw, parempodia setiform (fig. 40D). Abdomen: Tapered somewhat posteriorly. GENITALIA (figs. 40E, F, 41): Pygophore: Weakly conical, with a conspicuous tubercle on left side bearing heavy setae of moderate length. Vesica: S-shaped and three-dimensional, formed of two straps, apically with three slender spines, two extending in parallel well beyond gonopore, the other somewhat shorter and bent; secondary gonopore moderately large, well sclerotized, ovoid, without gonopore sclerite. Phallotheca: Elongate apically, relatively broad, with a sclerotized keel on apicodorsal margin, lacking spinelike projections as found in most *Phymatopsallus*-group taxa. Parameres: Left paramere with anterior and posterior processes simple, lacking in unique structural features; right paramere broadly lanceolate, apex elongate, slender, attenuated in the form of a sclerotized decurved spine.

Female: Elongate ovoid; total length 2.54–2.63, length apex clypeus–cuneal fracture 1.77–1.86, width pronotum 0.75–0.84. COLORATION (fig. 3): As in male. SURFACE AND VESTITURE: As in male. STRUCTURE: Hemelytra extending somewhat past apex of abdomen; eyes usually smaller than in male, vertex relatively broader (figs. 3); antennal segment 2 distinctly tapered proximally, in contrast to condition in male.

GENITALIA (fig. 41): Sclerotized rings large, twisted; vestibulum forming a sclerotized, relatively short, tubular structure; posterior wall apparently simple with no visible ornamentation.

ETYMOLOGY: Named for Joseph C. Schaffner, in recognition of his work on the Mexican Miridae during his professorial career at Texas A&M University, in combination with the generic name *Psallus*. Gender masculine.

DISCUSSION: The spotting on the dorsum, albeit not uniform, and the presence of a conspicuous tubercle on the left side of the pygophore suggest a possible relationship of this taxon with the *Phymatopsallus* group. However, the membrane is not marmorate and the right paramere is lanceolate, drawn to a fine, elongate, sclerotized spine apically, and does not lay directly over the phallotheca in repose. The presence of a tubercle on the pygophore shows little congruence with other characters and is therefore not an unequivocal diagnostic feature for the *Phymatopsallus* group of genera.

In addition to *Schaffneropsallus oaxacensis*, new species, I have examined other material from southern Mexico in which the right paramere is almost identical in form, with the strongly attenuated spinelike apex. These specimens, representing more than one species, are all spotted, but do not possess the tubercle on the pygophore. Neither is the membrane marmorate, as in all known species here placed in the *Phymatopsallus* group.

Schaffneropsallus oaxacensis, new species
figures 3, 40, 41; map 8

DIAGNOSIS: See generic diagnosis.

DESCRIPTION: See generic description.

HOST: Unknown.

DISTRIBUTION (map 8): Oaxaca, Mexico.

ETYMOLOGY: Named for its occurrence in the Mexican state of Oaxaca.

HOLOTYPE: **MEXICO: Oaxaca:** Jalapa del Marquez [16.5°N 95.46666°W], 04 Aug 1980, Schaffner, Weaver, Friedlander, 1♂ (AMNH_PBI 00058285) (TAMU).

PARATYPES: **MEXICO: Oaxaca:** 12.4 mi W of Tehuantepec, 16.33325°N 95.42124°W, 04 Aug 1980, Schaffner, Weaver, Friedlander, 1♂ (AMNH_PBI 00058288) (TAMU). Jalapa del Marquez, 16.5°N 95.46666°W, 04 Aug 1980, Schaffner, Weaver, Friedlander, 2♂ (AMNH_PBI 00058286, AMNH_PBI 00058287), 3♀ (AMNH_PBI 00058289–AMNH_PBI 00058291) (TAMU).

PHYLOGENETIC ANALYSIS

The *Phymatopsallus* group of genera offers a wealth of morphological information, particularly in the male and female genitalia, providing the potential for detailed phylogenetic analysis. Table 2 presents a list of character descriptions for the group; table 3 shows the distributions of those characters within the *Phymatopsallus* group, as well as three outgroup taxa.

The data shown in tables 2 and 3 were analyzed with NONA (Goloboff, 1998) using the mult* (with 20 interations) and max* branch-swapping commands; the hold command was set at 10,000, allowing space for a maximum of 10,000 trees. The number of trees found was 127 with a length of 121 steps, consistency index of 55, and a retention index of 81. The strict consensus of those 127 trees resolves the genera recognized in the present paper but is not particularly informative with regard to the relationships among those genera. However, successive approximations weighting (Farris, 1969; Carpenter, 1988) selected only one of the original trees, shown in figure 42; unambiguous optimizations of character data, as provided by the program WinClada (Nixon, 2000), are shown. Because some characters allow for more than one possible optimization on the tree, these are not shown on the cladogram. Analysis of the same data with PIWE (Goloboff, 1993, 1997)—which produces best fit trees by maximizing the sum of the average unit consistency index—using the same set of commands as above, produced a single tree shown in figure 42, with a fit statistic of 210.5.

Thus, although many of the characters in the dataset are homoplastic to a greater or lesser degree, as can be appreciated from the consistency index of 0.55, there is substantial phylogenetic signal from those characters as reflected in the retention index of 0.81 and the identical results produced through the use of successive approximations weighting of

TABLE 2
Descriptions of Characters and States

Head

0. shape of head: 0) height of head equal to body, head not tapered ventrally; 1) head elongate, head tapered toward base of labium

Coloration

1. coloration of head, pronotum, scutellum: 0) unicolorous pale; 1) unicolorous green greenish with brown spots; 2) pink or red with brown spots; 3) pale with green spots; 4) pale with orange spots
2. coloration of hemelytra: 0) unicolorous pale; 1) unicolorous green; 2) greenish with brown spots; 3) pink or red with brown spots; 4) pale with green spots; 5) pale with orange spots
3. membrane coloration: 0) without markings; 1) marmorate; 2) marmorate, but with large dark areas; 3) with prominent dark marking only
4. femoral coloration: 0) unicolorous pale; 1) with some dark spots
5. tibial coloration: 0) spines with dark bases; 1) pale, unicolorous, no dark spine bases

Sexual Dimorphism

6. antennal dimorphism: 0) segment 2 not sexually dimorphic, weakly tapering in male; 1) segment 2 sexually dimorphic, parallel-sided in male
7. eyes, sexual dimorphism: 0) at most weakly dimorphic; 1) dimorphic, larger in males than females

Male Genitalia

8. genital capsule size and shape: 0) capsule of moderate size, tapering toward apex; 1) very large, broad, occupying much of abdomen
9. pygophore, tubercle on left side: 0) absent; 1) weakly elevated above surrounding cuticle; 2) distinctly elevated above surrounding cuticle
10. pygophore, setae on tubercle: 0) absent; 1) elongate simple setae; 2) short spinelike setae; 3) heavy setae of moderate length
11. vesica structure: 0) tubular, formed of a single strap; 1) membranous on one side, forming a gutter from a single strap; 2) vesica formed of two straps
12. vesical spine: 0) absent; 1) present
13. condition of vesical spine: 0) at least 2 times length of gonopore, inserted basad of gonopore; 1) about length of gonopore, inserted at base of gonopore; 2) about length of gonopore, inserted at midpoint of gonopore
14. apex of vesica: 0) single process, nearly one-half length of vesica; 1) single process, about length of gonopore; 2) single process, about 2 times length of gonopore; 3) single process, about 3 times length of gonopore; 4) two processes, variously elaborated
15. length of vesica: 0) relatively short, C or J shaped; 1) moderately long, not obviously C or J shaped; 2) moderately long, filamentous; 3) very long, filamentous; 4) S shaped
16. left paramere body, thumblike process on anterodorsal margin: 0) absent; 1) present
17. left paramere, general form of anterior process: 0) simple, as a single attenuated structure; 1) bifid, as spines or hornlike structures
18. left paramere, shape of anterior process: 0) simple, not broadened or elongated; 1) finch beak shape, broad, heavily sclerotized; 2) short, moderately broad, blunt; 3) enlarged, greatly elongated and angled; 4) elongated, attenuated, relatively slender
19. left paramere, form of bifid anterior process: 0) cloven; 1) simple; 2) cow-horn shaped
20. left paramere, shape of posterior process: 0) simple, nearly straight, more or less accuminate; 1) simple, nearly straight, truncate apically; 2) curving, with terminal knoblike ornamentation
21. left paramere, separation of posterior process from paramere body: 0) no separation; 1) separated only at dorsal margin; 2) distinctly separated from paramere body
22. right paramere: 0) lanceolate; 1) moderately elongate, weakly parallel-sided; 2) elongate, conspicuously parallel-sided
23. right paramere, condition of terminal processes: 0) apically with a single process, strongly attenuated; 1) apically with a single process, not strongly attenuated; 2) with two processes, both short or only one weakly developed; 3) with two processes, both moderately developed; 4) with two processes, left process much longer than right, fingerlike
24. phallotheca, apical form: 0) tapering toward apex; 1) apex flattened; 2) apex broad, blunt
25. phallotheca, apical fold or ridge: 0) none; 1) triangular fold on dorsal margin; 2) dorsal margin with an elongate ridge
26. phallotheca, sclerotized dorsal tubercles or keel: 0) dorsal margin beset with sclerotized tubercles; 1) dorsal margin without distinct sclerotization; 2) dorsal margin with an elevated, sclerotized keel along entire length
27. phallotheca, processes: 0) absent; 1) single, spinelike or flattened, on ventral margin; 2) double, on ventral margin, and anterodorsal margin; 3) single, thumblike, on anterior surface; 4) double, on dorsal margin

Female Genitalia

28. vestibulum length and structure in female: 0) without obvious tubular structure, sclerites small; 1) very short basal tube; 2) elongated, nautiloid enlargement distally, parallel entrance-exit
29. vestibulum, details of elongate type: 0) tubular section moderately long, nautiloid portion large; 1) tubular section very long, small nautiloid development
30. vestibulum, sclerotized envelope: 0) absent; 1) present

TABLE 3
Character Data for Phymatopsalles-Group Taxa

	0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 2 2 2 2 2 2 2 2 2 3 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0
Additivities	+ − − − + + + + + − − + − − − + + − + + − + + − − + − + + +
Platyscytus paulistanus	1 0 0 0 0 1 0 0 0 0 0 − 0 − 0 0 0 0 0 1 − 0 0 1 0 0 1 0 − − 0
Lineatopsallus biguttulosus	0 0 0 3 0 0 1 0 0 0 0 1 0 − − 0 0 0 0 1 0 0 0 1 0 0 1 0 − − 0
Schaffneropsallus oaxacensis	0 5 5 0 1 0 1 1 0 2 3 2 0 − 4 4 0 0 1 1 1 0 0 0 0 0 1 0 1 − 0
Arizonapsallus stonedahli	0 2 2 1 1 0 1 0 0 0 0 1 0 − 4 0 0 0 0 1 0 0 1 2 0 1 1 0 0 − 0
Angelopsallus gregalis	0 1 1 1 1 0 0 1 0 0 0 1 0 − 2 1 0 0 2 1 1 0 2 3 0 0 1 1 2 0 0
Bisulcopsallus fulvipunctatus	0 3 3 1 1 0 0 0 1 2 1 1 0 − 2 3 0 1 − 0 2 2 2 3 0 0 1 1 2 1 0
Bisulcopsallus fuscipunctatus	0 0 2 2 1 0 0 0 1 2 1 1 0 − 2 3 0 1 − 0 2 1 2 3 0 1 1 1 2 1 0
Bisulcopsallus huachucae	0 0 3 2 1 0 0 0 1 2 1 1 0 − 2 3 0 1 − 0 2 1 2 3 1 0 1 1 2 1 0
Bisulcopsallus pallidus	0 0 0 2 0 0 0 0 1 2 1 1 0 − 2 3 0 1 − 0 2 1 2 3 1 0 1 1 2 1 0
Bisulcopsallus polhemorum	0 0 2 2 1 0 0 0 1 2 1 1 0 − 2 3 0 1 − 0 2 2 2 3 0 0 1 1 2 1 0
Bisulcopsallus texanus	0 0 2 2 1 0 0 0 1 2 1 1 0 − 2 3 0 1 − 0 2 1 2 3 0 0 1 1 2 1 0
Ceratopsallus aquilonius	0 0 2 2 1 0 0 0 1 2 1 1 0 − 2 1 0 1 − 2 2 2 2 4 1 2 1 1 2 0 1
Ceratopsallus croceus	0 5 5 2 1 0 1 1 1 2 1 1 0 − 2 1 0 1 − 2 2 2 2 4 1 0 1 1 2 0 1
Ceratopsallus pantherinus	0 5 5 2 1 0 1 1 1 2 1 1 0 − 2 2 0 1 − 2 2 2 2 3 1 0 1 1 2 0 1
Ceratopsallus pintoi	0 2 2 2 1 0 0 0 1 2 1 1 0 − 2 1 0 1 − 2 2 2 2 4 0 1 1 1 2 0 1
Ceratopsallus plautus	0 2 2 2 1 0 0 0 1 2 1 1 0 − 2 0 0 1 − 2 2 1 2 3 0 1 1 2 2 0 1
Ceratopsallus quercicola	0 0 2 2 1 0 0 0 1 2 1 1 0 − 2 0 0 1 − 2 2 2 2 3 0 1 1 1 2 0 1
Ceratopsallus ribesi	0 0 2 2 1 0 0 0 1 2 1 1 0 − 2 0 0 1 − 2 2 2 2 4 2 2 1 1 2 0 1
Ceratopsallus schwartzi	0 0 2 2 1 0 0 0 1 2 1 1 0 − 2 0 0 1 − 2 2 1 2 4 0 0 1 2 2 0 1
Ceratopsallus septentrionalis	0 0 2 2 1 0 0 0 1 2 1 1 0 − 2 2 0 1 − 2 2 2 2 4 2 0 1 1 2 0 1
Ceratopsallus vauqueliniae	0 0 2 1 1 0 1 1 1 2 1 1 0 − 2 0 0 1 − 2 2 2 2 3 0 0 1 2 2 0 1
Cercocarpopsallus bispinosus	0 0 2 2 1 0 0 0 1 1 2 1 0 − 4 0 0 0 3 1 1 0 2 3 0 1 1 0 1 − 0
Cercocarpopsallus gracilis	0 0 2 2 1 0 0 0 1 1 2 1 0 − 4 1 0 0 2 1 0 0 2 3 0 1 1 0 1 − 0
Knightopsallus portalensis	0 1 1 1 1 0 ? ? 0 0 0 1 0 − 1 0 0 0 1 1 1 0 1 2 0 0 1 3 ? − 0
Phymatopsallus acaciae	0 1 1 1 1 0 1 0 0 2 1 0 1 0 3 0 1 0 4 1 1 0 1 2 2 0 0 3 1 − 0
Phymatopsallus dubiosus	0 1 1 1 1 0 1 1 0 2 1 0 1 0 3 0 1 0 4 1 1 0 1 2 2 0 0 3 1 − 0
Phymatopsallus patagoniae	0 1 1 1 1 0 1 1 0 2 1 0 1 0 3 0 1 0 4 1 1 0 1 2 2 0 0 3 1 − 0
Phymatopsallus rinconae	0 1 1 1 1 0 1 1 0 2 1 0 1 0 3 0 1 0 4 1 1 0 1 2 2 0 0 3 1 − 0
Phymatopsallus tuberculatus	0 1 1 1 1 0 1 1 0 2 1 0 1 0 3 0 1 0 2 1 1 0 1 2 2 0 0 3 1 − 0
Salicopsallus lucidus	0 0 0 1 1 0 ? ? 0 2 1 1 1 1 1 0 0 0 1 1 0 0 1 2 1 0 2 3 1 − 0
Salicopsallus schwartzi	0 1 2 1 1 0 1 1 0 2 1 1 1 1 1 0 0 0 1 1 0 0 1 2 1 0 2 3 1 − 0
Stictopsallus aspersus	0 0 3 1 1 0 1 1 0 0 0 1 1 2 1 0 0 0 1 1 1 0 1 3 1 0 1 4 0 − 0

the 127 most parsimonious trees found by NONA and the single tree found by PIWE.

Major phyletic lines within the *Phymatopsallus* group, indicated by node numbers in figure 42, are defined in part on the basis of the following characters:

Node 1. *Phymatopsallus* group: Membrane marmorate, right paramere moderately elongate, weakly parallel-sided, and with two terminal processes.

Node 2. *Phymatopsallus* clade: Apex of vesica with a single process about the length of secondary gonopore and phallotheca with a single thumblike process ("spine") on the anterior surface.

Node 3. *Stictopsallus* clade: Vesical spine present and apex of vesica flattened.

Node 4. *Salicopsallus* clade: Pygophore with an elevated tubercle on the left side, tubercle with elongate simple setae.

Node 5. *Salicopsallus:* Dorsal margin of phallotheca with an elevated, sclerotized keel along entire length.

Node 6. *Phymatopsallus:* Vesica tubular, formed of a single strap, left paramere with thumblike process on anterodorsal margin, and dorsal margin of phallotheca beset with sclerotized tubercles, among other characters.

Node 7. *Cercocarpopsallus* clade: Antennal segment 2 not sexually dimorphic, and right

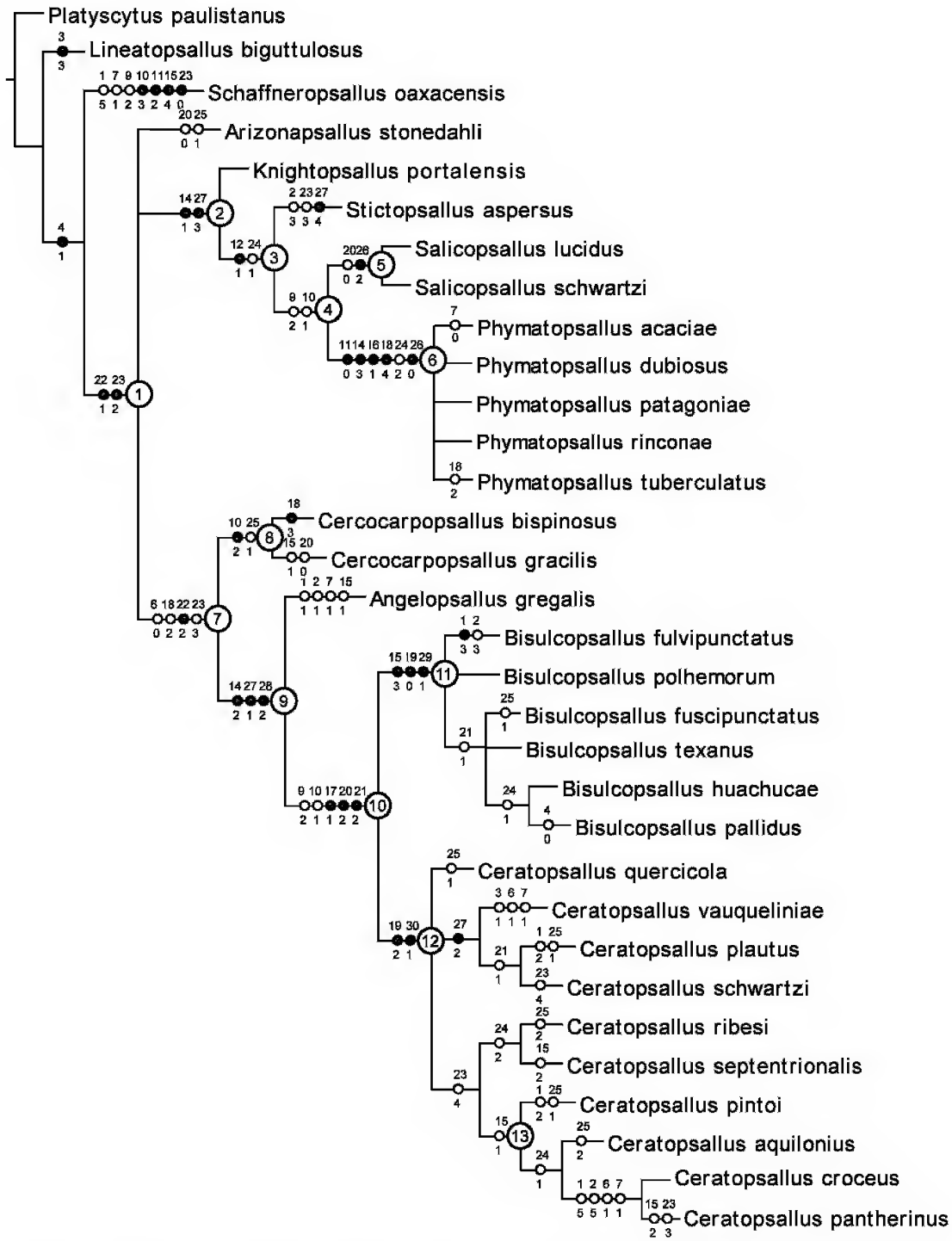

Fig. 42. Phylogenetic relationships of *Phymatopsallus*-group taxa. Characters showing no homoplasy are indicated by filled circles; characters showing homoplasy are indicated by open circles (See text for explanation of methods).

paramere elongate, conspicuously parallel-sided.

Node 8. *Cercocarpopsallus:* Pygophore with short, spinelike setae, triangular fold on dorsal margin of phallotheca.

Node 9. *Angelopsallus* clade: Apex of vesica a single process about 2 times length of secondary gonopore, phallotheca with a single spine on ventral margin, and vestibulum elongated with nautiloid enlargement distally and adjacent entrance-exit.

Node 10. *Ceratopsallus* clade: Pygophore with an elevated tubercle on left side, tubercle with elongate simple setae, left paramere with anterior process bifid, with posterior process curving, with terminal knoblike ornamentation, and distinctly separated from paramere body.

Node 11. *Bisulcopsallus:* Vesica very long, filamentous, left paramere with anterior process cloven, and vestibulum very long with a small nautiloid development.

Node 12. *Ceratopsallus:* Left paramere with anterior process cow horn-shaped, vestibulum with sclerotized envelope.

Whereas Knight (1964) conceived the tubercle on the pygophore (character 9) as a defining feature of *Phymatopsallus* as he construed it, the present phylogenetic analysis treats the tubercle as having evolved three times: in *Schaffneropsallus*, at node 4, and at node 10. Nonetheless, the tree shown in figure 42 maximizes agreement among a large number of characters on the tree and, as discussed further below, receives substantial "reciprocal illumination" (Hennig, 1966) from patterns of geographical distribution and host associations.

BIOGEOGRAPHIC RELATIONSHIPS

Many phyline genera in the Nearctic, including, among others, *Megalopsallus* Knight (see Schuh, 2000a), *Oligotylus* Slater and Knight (see Schuh, 2000b), and *Tuxedo* Schuh (see Schuh, 2004a), as well as orthotyline genera such as *Pseudopsallus* Van Duzee (Stonedahl and Schwartz, 1986), *Ramentomiris* Stonedahl and Schuh, and *Squamacoris* Knight (Stonedahl and Schuh, 1986), are restricted to the western North America and show great diversity there. The patterns seen in the above-mentioned genera find parallels in other taxa such as *Chlamydatus* Curtis (see Schuh and Schwartz, 2005), *Europiella* Reuter (see Schuh, 2004b), and other groups of Phylinae, which, although not restricted to western North America, show their greatest diversity there and manifest restricted patterns of endemism. *Phymatopsallus*-group taxa show strong similarity to *Megalopsallus* in having substantial diversity in the Sonoran Desert, but unlike the former, are not primarily associated with halophytes.

In the broadest sense, *Phymatopsallus*-group taxa display distributions that might be classified as Sonoran–Chihuahuan, as seen in the *Phymatopsallus* clade, Californian, as seen in the genus *Ceratopsallus*, and Great Basin–Rocky Mountain, as seen in some members of the genus *Bisulcopsallus*. This classification, however, reflects the distributions of larger clades and some widespread species, and as such it is too crude to allow for the recognition of areas of endemism. As a way of conducting a more in-depth biogeographic analysis, the following areas of endemism were postulated on the basis of known *Phymatopsallus*-group distributions:

Southern Mexico (Oaxaca–Chiapas)
Southern Arizona + Sonora, Mexico
Imperial Valley (low elevation SE California)
Baja California (non-Mediterranean)
Southern New Mexico + west Texas
Southern Nevada
Southern California (San Joaquin Valley and adjacent Sierra Nevada)
Northern California (Sacramento Valley, adjacent Sierra Nevada, extreme SW Oregon)
Oregon (central and northern interior)
Utah + NE Arizona (montane areas)
Colorado + NE Arizona (montane areas)

Some of these areas, such as Southern New Mexico + West Texas and Oregon, are not unique to any single taxon, but nonetheless are not part of the intersection of distributions for two or more widespread species. Other recognized areas, such as northern California and southern California, might be viewed as overly crude characterizations, but existing distributional data, particularly in California, do not exist in sufficient detail to allow for more precise circumscriptions.

Phymatopsallus-group distributions were analyzed by assigning individual species to

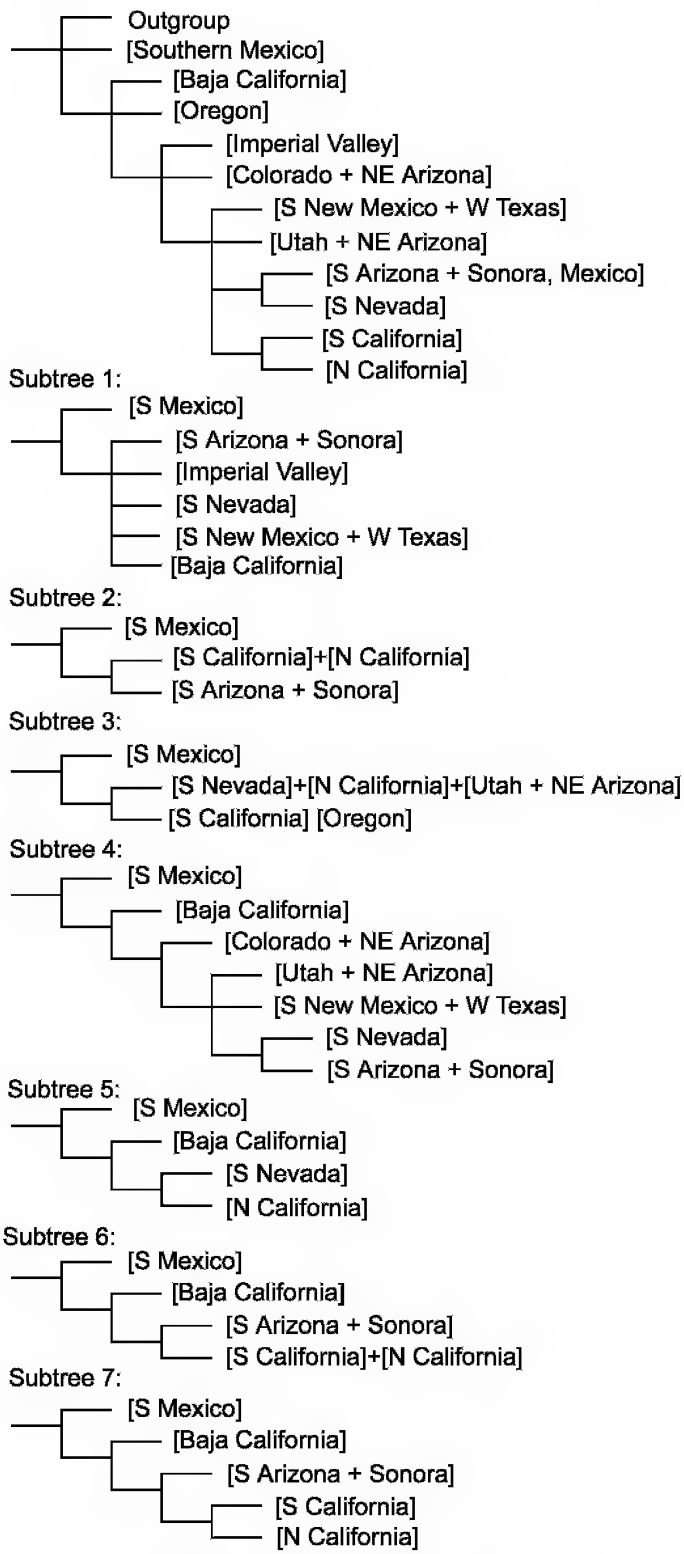

Fig. 43. Paralogy-free trees portraying biogeographic relationships of *Phymatopsallus*-group taxa (see text for explanation).

one or more of the areas identified above and then applying the methods described by Nelson and Ladiges (1996) for the construction of "paralogy-free" area cladograms. The result included seven subtrees, shown in the lower part of figure 43. Those subtrees are compatible and form the combined area cladogram shown at the top of figure 43.

Examination of the subtrees and combined area cladogram may allow us to draw some initial conclusions:

1. Southern Mexico is the uncontradicted sister area of the remaining areas on the cladogram.
2. Baja California is then sister to all remaining areas in those subtrees where it occurs and where there is resolution of areas beyond the basal dichotomy.
3. In all but one subtree (4), southern Arizona is then sister to all remaining areas in those subtrees where it occurs and where there is resolution of areas beyond the basal dichotomy.
4. Southern California and northern California appear to be sister areas.
5. Imperial Valley and Oregon are placed in relatively basal positions on the area cladogram because these areas are not distinct to any taxon, but rather part of more widespead distributions and—particularly in the case of Oregon—taxon distributions that include several other areas.
6. Colorado + E Arizona pertains only to *Bisulcopsallus polhemorum*, whose position on the cladogram is unresolved relative to other members of the genus. For this reason, and because this area is unique to *B. polhemorum*, its position in the area cladogram is also ambiguous.

With these observations in hand, we might conclude that although some area relationships appear to be revealed by *Phymatopsallus*-group taxa, others remain ambiguous because of widespread distributions and lack of resolution in certain areas of the taxon cladogram. What seems certain is that the Sonoran Desert region of Arizona is extremely diverse within the taxon, and that it forms a complex relationship with both California and areas in the interior of western North America. The latter aspect of this relationship is seen graphically in maps 2, 3, and 4, where *Bisulcopsallus* is restricted to the Rocky Mountain system, western Texas, and higher elevations in Arizona, whereas its sister group *Ceratopsallus* is diverse and widespread in California, with limited occurrences in adjacent southern Nevada and Arizona, and overlapping with *Bisulcopsallus* only in those areas.

It is equally clear that knowledge of diversity in the group in Mexico is woefully inadequate compared to that for the United States. In the long run, the ranges of some additional species will certainly be shown to extend into northern Mexico, with the possibility that additional diversity will be discovered there.

Even in the face of inadequate geographic sampling, the distributional patterns in the *Phymatopsallus* group find certain broad parallels in what we see in other taxa. Notable among these is the sister-area relationship of portions of central/southern Mexico with the western United States and adjacent Mexico. This pattern has been documented in phylogenetic analyses of the *Squamocoris* generic group by Stonedahl and Schuh (1986) and the *Pseudopsallus* generic group by Stonedahl and Schwartz (1986, 1988).

Furthermore, the virtual restriction of certain clades such as *Ceratopsallus* to California and northern Baja California, with some outlying taxa or distributions in Arizona, is repeated in many other genera, but *Oligotylus* Van Duzee, *Phallospinophylus* Weirauch, *Pygovepres* Weirauch, and *Tuxedo* Schuh might be cited as excellent examples.

Additional fieldwork and analytic work on the faunas of Mexico and the American West should help to clarify the generality of these patterns as well as better define areas of endemism.

HOST RELATIONSHIPS

To better understand the evolution of host associations in *Phymatopsallus*-group taxa, host occurrences have been optimized on the cladogram of bug relationships shown in figure 42, following the approach taken by Carpenter (1989). Host occurrences were treated as states of a character and optimized on the morphology-based cladogram. Host data were coded at the family level, and thus no distinction was made between occurrences on *Acacia*, *Cercidium*, and *Prosopis* (Fabaceae), *Ceanothus*, *Rhamnus*, and *Zizyphus*

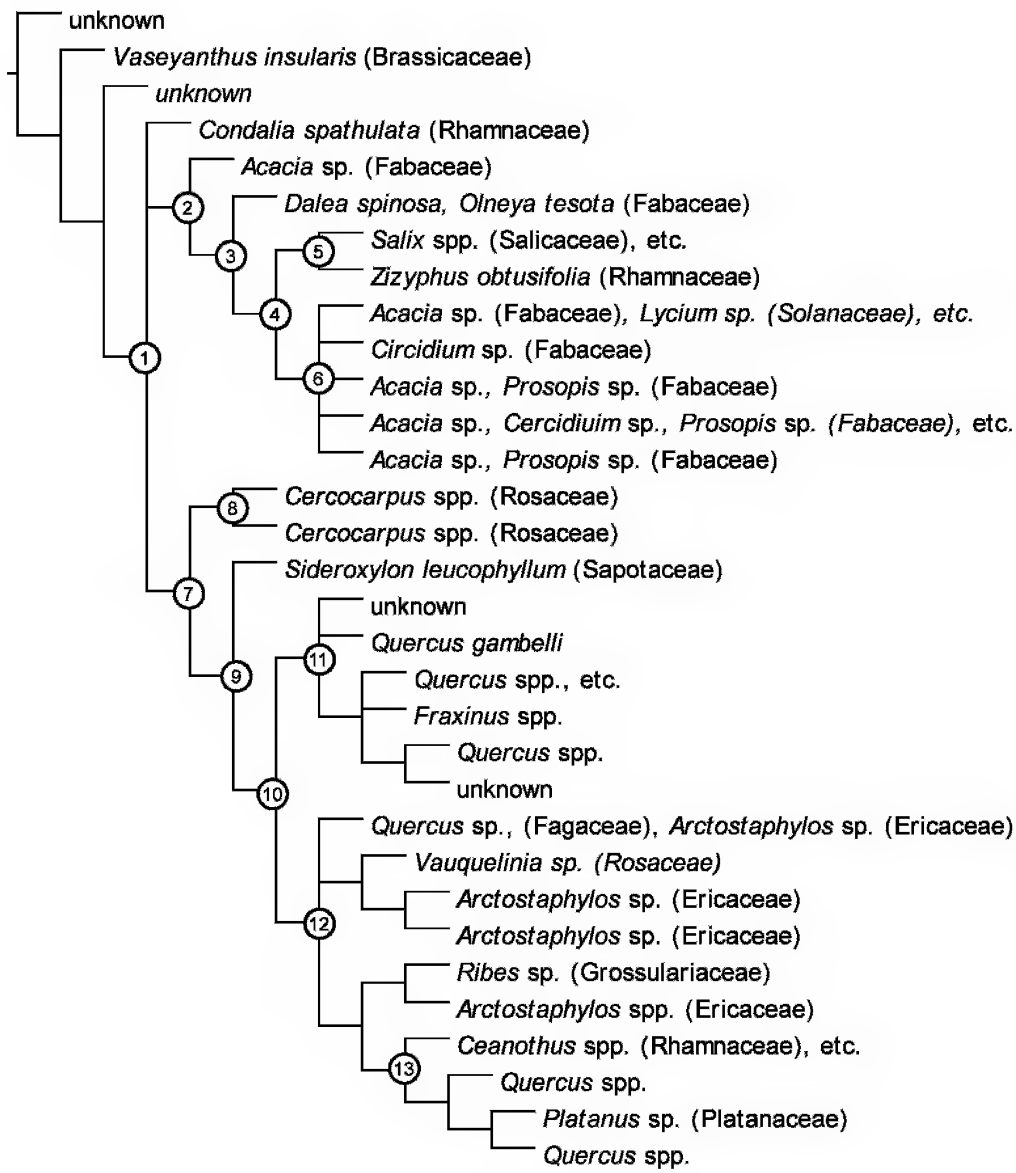

Fig. 44. Taxon-host cladogram for Phymatopsallus-group taxa (see text for explanation).

(Rhamnaceae), or *Amelanchier*, *Cercocarpus*, and *Purshia* (Rosaceae). *Ceratopsallus pintoi* and *C. quercicola* were coded as polymorphic because they have recorded hosts from different plant families. Single occurrences on a given host were sometimes not included when contradicted by all other data. Figure 44 reproduces the topology of figure 42 but replaces bug taxon names with host occurrences. Optimization of hosts by numbered nodes and terminal taxa on the cladogram is according to the pattern on p. 110.

The basal host condition for the *Phymatopsallus* group is ambiguous because the host of the immediate outgroup, *Schaffneropsallus*, is unknown and because available character data do not form a dichotomous resolution at the base of the tree. Nonetheless, three family-level host affiliations are evident within the analysis.

Node 1. *Phymatopsallus* group: optimization ambiguous
Arizonapsallus (Rhamnaceae)
Node 2. *Phymatopsallus* clade: Fabaceae
Node 3. *Stictopsallus* clade: Fabaceae
Node 4. *Salicopsallus* clade: Fabaceae
Node 5. *Salicopsallus*: Rhamnaceae
Node 6. *Phymatopsallus*: Fabaceae
Node 7. *Cercocarpopsallus* clade: Rosaceae
Node 8. *Cercocarpopsallus*: Rosaceae
Node 9. *Angelopsallus* clade: Fagaceae
Angelopsallus: Sapotaceae (*Sideroxylon*)
Node 10. *Ceratopsallus* clade: Fagaceae
Node 11. *Bisulcopsallus*: Fagaceae
Node 12. *Ceratopsallus*: Ericaceae
Node 13. *Ceratopsallus pintoi* group: Fagaceae

First, there is strong evidence for the original restriction of *Phymatopsallus* clade (node 2) to the Fabaceae, including particularly the genera *Acacia*, *Cercidium*, *Psorothamnus*, *Olneya*, and *Prosopis*. These woody genera are all dominant landscape elements in the American Southwest. The Salicaceae-Rhamnaceae feeding preferences within *Salicopsallus* (node 5) would appear to be secondarily derived. No other *Phymatopsallus*-group taxon is known to feed on the Fabaceae.

The *Cercocarpopsallus* clade (node 7) is basally associated with *Cercocarpus* (Rosaceae), an association based on multiple records for *Cercocarpopsallus bispinosus* and a single record for *C. gracilis*, but with multiple collection events for the latter species, all of which are consistent with a *Cercocarpus* association. The subsequent branching event (node 9) is optimized to treat *Quercus* as the basal condition. *Sideroxylon* (Sapotaceae), the host of *Angelopsallus*, is based on a single collection, and when optimized on the current cladogram appears as a unique event.

Optimization of node 10 continues to treat *Quercus* (Fagaceae) as basal within the taxa arising from that node. Although hosts are not known for two of the species of *Bisulcopsallus* (node 11), the basal condition in the taxon is optimized as *Quercus* with *Fraxinus*-feeding being treated as autapomorphic. This optimization allows the prediction that *B. fulvipunctatus* and *B. pallidus* are also *Quercus* feeders.

The basal condition for *Ceratopsallus* (node 12) is optimized as Ericaceae, with Fagaceae being a secondary reacquisition in the clade (node 13) containing *C. croceus*, *C. pantherinus*, and *C. pintoi*. Further collecting and host documentation for *Ceratopsallus*, as well as a more robust result concerning relationships within the group, will help corroborate or reject these conclusions.

Although *Ceanothus*, *Cercocarpus*, *Quercus*, and *Salix*, among other plant taxa, serve as hosts to *Phymatopsallus*-group species—as well as large numbers of other Miridae species in North America—the association of the bug taxa *across* plant lineages appears to be primarily ecological, rather than systematic. This theory receives support from prior studies in the Miridae, such as those of Stonedahl and Schwartz (1986) on *Pseudopsallus* and Stonedahl and Schuh (1986) in *Squamocoris* and its near relatives. In some cases, such as *Plagiognathus* Fieber, the evidence for ecologically derived host associations is particularly graphic, with multiple independent instances of Coniferae feeding embedded with a larger Angiospermae-feeding group of bugs (Schuh, 2001).

Even though *Phymatopsallus*-group taxa feed on a relatively broad array of host lineages, the optimization of host occurrences on the *Phymatopsallus*-group cladogram (fig. 44) indicates substantial congruence between host preference and phylogenetic relationships within the bugs. This "reciprocal illumination" (Hennig, 1966) demonstrates the power of phylogenetics in evolutionary biology, and helps to predict where we might best concentrate our efforts in the search for new host records for the *Phymatopsallus* group.

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Steve Thurston inked the genitalic illustrations, prepared their final digital renderings, and assembled all plates in digital form for publication. My special thanks to Steve, because his extensive assistance was crucial in bringing this manuscript to completion.

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The following individuals and institutions provided material for this study. Without their generous assistance, the diversity, distributions, and host relationships for species in the group would be much less well understood. Institutional abbreviations are presented in the following list:

AMNH	American Museum of Natural History, New York
CAFA	California Department of Food and Agriculture, Sacramento, Alan Hardy
CAS	California Academy of Sciences, San Francisco, Paul Arnaud, Jr., Norman Penny
CNC	Canadian National Collection of Insects, Agriculture Canada, Ottawa, Michael D. Schwartz
CUIC	Cornell University Insect Collection, Ithaca, New York, James K. Liebherr, E. Richard Hoebeke
JTP	John T. Polhemus Collection, Englewood, Colorado
KU	University of Kansas, Snow Entomological Museum, Lawrence, Alex Slater, Zachary Falin
LACM	Natural History Museum of Los Angeles County, Julian P. Donahue
ORSU	Oregon State University Arthropod Collection, Corvallis, John D. Lattin
TAMU	Texas A&M University, College Station, Joseph C. Schaffner, Edward C. Riley
UCB	University of California, Berkeley, John Chemsak, Cheryl Barr
UCD	University of California, Davis, the late Robert Schuster
UCR	University of California, Riverside, Saul Frommer, John D. Pinto, Douglas Yanega
UNAM	Instituto de Biologia, Universidad Nacional Autonomo de Mexico, Mexico, D.F., Harry Brailovsky
USNM	United States National Museum of Natural History, Washington, D.C., Thomas J. Henry, Michele Touchet
USU	Utah State University, Logan, Wilford J. Hanson

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APPENDIX 1

Unique Specimen Identifiers for Habitus Illustrations of *Phymatopsallus*-Group Taxa

Angelopsallus gregalis: male (AMNH_PBI 00077130); female (AMNH_PBI 00077133).

Arizonapsallus stonedahli: male (AMNH_PBI 00096981); female (AMNH_PBI 00096985).

Bisulcopsallus croceguttatus: female (AMNH_PBI 00069803).

Bisulcopsallus fulvipunctatus: male (AMNH_PBI 00068616); female (AMNH_PBI 00068618).

B. fuscipunctatus: male (AMNH_PBI 00063210); female (AMNH_PBI 00063213).

B. huachucae: male (AMNH_PBI 00063222); female (AMNH_PBI 00063226).

B. pallidus: male (AMNH_PBI 00068622); female (AMNH_PBI 00068626).

B. polhemorum: male (AMNH_PBI 00063434); female (AMNH_PBI 00063437).

B. texanus: male (AMNH_PBI 00063227); female (AMNH_PBI 00068632).

Ceratopsallus aquilonius: male (AMNH_PBI 00071906); female (AMNH_PBI 00071912).

C. croceus: male , left (AMNH_PBI 00068782); male, right (AMNH_PBI 00074864).

C. pantherinus: male (AMNH_PBI 00068637); female (AMNH_PBI 00077140).

C. pintoi: male , left (AMNH_PBI 00082301), male , right (AMNH_PBI 00063242); female, left (AMNH_PBI 00082305), female, right (AMNH_PBI 00063129).

C. plautus: male (AMNH_PBI 00071879); female (AMNH_PBI 00071884).

C. quercicola: male (AMNH_PBI 00063251); female (AMNH_PBI 00063256).

C. ribesi: male (AMNH_PBI 00071877); female (AMNH_PBI 00068636).

C. schwartzi: male (AMNH_PBI 00071915); female (AMNH_PBI 00071883).

C. septentrionalis: male (AMNH_PBI 00063262); female (AMNH_PBI 00063266).

C. vauqueliniae: male (AMNH_PBI 00063232); female (AMNH_PBI 00063237).

Cercocarpopsallus bispinosus: male (AMNH_PBI 00063147); female (AMNH_PBI 00063148).

C. gracilis: male (AMNH_PBI 00071864); female (AMNH_PBI 00071868).

Knightopsallus portalensis: male (AMNH_PBI 00063145).

Phymatopsallus acaciae: male (AMNH_PBI 00063132); female (AMNH_PBI 00071858).

P. dubiosus: male (AMNH_PBI 00063112); female (AMNH_PBI 00063111).

P. patagoniae: male (AMNH_PBI 00063153); female (AMNH_PBI 00063152).

P. rinconae: male (AMNH_PBI 00063128); female (AMNH_PBI 00063119).

P. tuberculatus: male (AMNH_PBI 00063141); female (AMNH_PBI 00063134).

Salicopsallus lucidus: male , left (AMNH_PBI 00071871), male , right (AMNH_PBI 00063175); female, left (AMNH_PBI 00071873), female right (AMNH_PBI 00068777).

S. schwartzi: male (AMNH_PBI 00063162); female (AMNH_PBI 00063167).

Stictopsallus aspersus: male , left (AMNH_PBI 00068609), male , right (AMNH_PBI 00063188); female, left (AMNH_PBI 00077128), female, right (AMNH_PBI 00063206).

Schaffneropsallus oaxacensis: male (AMNH_PBI 00058285); female (AMNH_PBI 00058291).

NOTE ADDED IN PROOF

Structure and function of the vestibulum: Pluot-Sigwalt and Matocq (2006) published a comprehensive literature review of the structure of the vulva and vestibulum in the Orthotylinae and Phylinae, augmented by substantial original observations. Because I was not aware of their work at the time the present revision was being prepared, I was not able to incorporate their observations into the overall context of my own work.

Pluot-Sigwalt and Matocq (2006) observed that it is difficult to understand the homology of structure between the Orthotylinae and Phylinae. Nonetheless, with regard to the Phylinae, they noted that the morphology and variation of the elongate sclerotized vestibulum are reasonably well documented, citing the works of Henry and Schuh (1979), Magnien (2000), and Wyniger (2006), among several others. Those works document the form of the vestibulum in some members of the phyline tribes Phylini and Hallodapini where the structure is elaborate and similar to what is seen in some members of the *Phymatopsallus* group of genera. In this regard, what I have referred to as the "nautiloid process" is apparently the same structure that other authors have termed the "ventral sac".

Pluot-Sigwalt and Matocq (2006) discussed the functional significance of the vestibulum in the Phylinae. Their view, echoing that of others, is that the vestibulum plays a role in the reception of the phallus and that its size and conformation are correlated with the size and shape of the phallus, opinions with which I largely concur. Some of the remaining discussion by Pluot-Sigwalt and Matocq concerning the functional significance of the vestibulum I regard as speculation.

My own morphological observations cause me to conclude that the role of the vestibulum, in line with the argument that it receives the phallus during copulation, is to conduct the sperm (spermatophore) to the seminal depository during copulation. No doubt this function is the same in all Phylinae (and probably in all Miridae); however, because the structures are more highly sclerotized and elaborate in many Phylinae than is the case in many other Miridae, the morphological evidence for the function is much easier to document. Nonetheless, there is variation within the Phylinae, not only in the degree of vestibular development, but also in the point of connection of the vestibulum with the seminal receptacle. The differences in point of connection can be easily seen by comparing the situation in *Larinocerus* Froeschner (as illustrated by Henry and Schuh [1979], and reexamined in the preparation of this note) and *Bisulcopsallus* and *Ceratopsallus* (this paper) for example. In the former taxon the entry and exit points of the vestibulum are widely separated, whereas in the latter groups the entry and exit appear to lie adjacent to one another.

The argument put forward by Pluot-Sigwalt and Matocq (2006), with which I do not agree, is that the vestibulum plays some role in oviposition. I see no physical evidence that the vestibulum is involved in conducting eggs from the ovaries to the ovipositor, as suggested by Pluot-Sigwalt and Matocq (2006). Davis (1955), in his study of the female genitalia in the Miridae, showed in his figure 19B that eggs pass from the oviduct to the ovipositor without traversing the vestibulum, an interpretation with which I agree.

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